NATURE

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"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH

THURSDAY, NOVEMBER 1, 1883

ZOOLOGICAL REPORTS OF THE VOYAGE OF H.M.S. "CHALLENGER"

Report on the Scientific Results of the Voyage of H.M.S. "Challenger" during the Years 1873-76, *under the Command of Capt. George S. Nares and Capt. F. T. Thomson.* Prepared under the Superintendence of the late Sir C. Wyville Thomson, Director of the Civilian Scientific Staff on board, and now of John Murray, one of the Naturalists of the Expedition. Zoology—Vol. V., 1882; Vol. VI., 1882; Vol. VII., 1883. (Published by Order of Her Majesty's Government.)

THE editor has made most excellent progress in the work of publishing the Reports of the scientific results of the voyage of H.M.S. *Challenger* during the past year, as the three bulky quarto volumes now before us well indicate. Vol. V. contains an elaborate Report on the Ophiuroidea by Theodore Lyman, who has made this group so long his special study, and who has in this monograph given us a most elaborate and beautifully illustrated contribution to science. The memoir contains the description of some twenty-one genera and of 170 species, but as several already described species were also collected, Mr. Lyman has judiciously given not only all these but also the names of all others previously described, arranged under their genera, constituting therefore this Report a more or less complete monograph of the Ophiuroidea. There are very elaborate tables of distribution, geographical, bathymetrical, and thermal, with brief remarks on their indications, and at the end of these is a note on the fossil forms and their relations to those living. In the descriptive part of the monograph Mr. Lyman has ventured to use simple words as often as possible, so as not to add to "the jargon in which zoology is now smothering."

Amid the three hundred pages of description of species there is of necessity little that will bear transcribing in a general notice of this important work; and still among them we find the following, which in the writer's mind awakened similar emotions to those referred to by Mr. Lyman:—"In my notebook of 1861 I find, '*Euryale exiguum*, Lamk., original of Peron and Leseur, 1803, young.' This prosaic line is poetical to me. It takes me back to the Jardin des Plantes as it was twenty years ago, and I can see the laboratories of the 'mollusques et zoophytes' where I studied under the kindly direction of old Valenciennes. He has gone, and so has his successor Deshayes, and their place is now worthily held by Perrier, who was a very young man when first I knew him. But still that poor little broken *Astrophyton exiguum* lies on its shelf, the survivor. It was with a real emotion that in unpacking the *Challenger* collection I drew from a large jar two fine specimens. I felt like a scholar who had found a duplicate of the Codex argenteus. After more than two generations the unique treasure of the Jardin des Plantes has at last other representatives, and to celebrate its rediscovery I could do no less than give a figure of the animal" (Plate 47).

So far as the geographical distribution of the group is concerned, it would appear that although deep-sea species are more inclined to extensive wanderings than those frequenting shallows, yet, speaking generally, they offer similar differences. Among littoral forms there are those which are found all over the great ocean from the Sandwich Islands to the east coast of Africa, and even south to the Cape of Good Hope. One species, *Amphiura squamata*, is found in the North and South Atlantic, at the Cape of Good Hope, and in Australia. Others, again, are considerably restricted; for example, the abundant fauna of the Carribean Sea, which reaches only Brazil on the south and the Carolinas on the north. *Ophiacantha vivipara* and *Gorgonocephalus pourtalesii* going to 140 and 600 fathoms, are remarkable for their extension in longitude, being found from the Kerguelen Islands on the west to the east coast of South America. As to the very deep-water species, *Ophiomusium lymani* occurs well up in the North Atlantic, in the extreme South Atlantic, near New Zealand, off Japan, and off the south-west coast of South America. *Ophiacantha cosmica* is found off the Brazil coast, between the Cape of Good Hope and the Kerguelen Islands, off the south-west coast of South America, and at intermediate points. Some of these deep-sea species are, however, quite restricted in their

area, such as *Pectinura heros*, *Ophiomusium validum*, and *Astroschema arenosum*, the first living near the Celebes, the last two in the Carribean Sea. While species differ thus much in the extent of their migrations, there are certain bottoms where they seem to decline to live at all. Thus in all the deep water from the centre of the North Pacific to near the south-west coast of South America, there was not a single Ophiuran found. As to their distribution in depth, a very large proportion live exclusively on the littoral zone, and therein are included species both of cold and of hot water, though the number of the latter is much the larger. Some fifty species live exclusively below 1000 fathoms, and have to endure a degree of cold near to freezing, an enormous water pressure, and an entire absence of sunlight.

The forty-eight, rather crowded, plates have been drawn with skill and fidelity by Miss K. Pierson and Mr. L. Trouvelot with the exception of Plate 48, which represents half of an arm of *Gorgonocephalus verrucosus*, carried out to its extreme twigs, and which stands as quite a monument of patience on the part of Mr. Lyman's assistant, Miss Clark.

The Second Report in this volume is by Prof. D. J. Cunningham, on some points in the anatomy of *Thylacinus cynocephalus*, *Phalangista maculata*, and *Phascogale calura*, with an account of the comparative anatomy of the intrinsic muscles and the nerves of the mammalian pes. This Report gives details of the anatomy of three little known mammals, representing types which differ widely from each other both in physique and habits. A special interest attaches to the anatomy of the Thylacine, as it is rapidly becoming extirpated. In examining the intrinsic muscles of the marsupial manus and pes, Prof. Cunningham encountered a somewhat puzzling multiplication of the elements. To clear this up and at the same time to connect the condition with that found in other animals he was induced to extend his inquiries upon this point into mammals in general, and we are therefore favoured with the results of this comparative research in a very elaborate report on the comparative anatomy of the mammalian foot.

Vol. VI. contains also two memoirs: the first is a Report on the Actiniaria, by Prof. Richard Hertwig. As a considerable number of specimens did not reach Königsberg until this Report was finished, we are promised a supplementary report to describe these additional forms. Fourteen plates accompany this Report. Beginning with a detailed description of a typical Actinian, we have also a comparative survey of the chief characteristics of the several divisions and genera. Six tribes of Actiniana are distinguished: (1) Hexactiniæ; (2) Paractiniæ; (3) Monauleæ; (4) Edwardsiæ; (5) Zoantheæ; (6) Ceriantheæ. Objecting to Verrill's assertion that all specimens of Actiniæ which are only known from preserved specimens should be thrown away as of no scientific value, Prof. Hertwig has laboured manfully over the unfortunately rather badly preserved specimens of the *Challenger* voyage; and by keeping in view such factors in their description as the structure of the tentacles, of the septa, of the oral disk, of the circular muscle, &c., he has presented a most minute and elaborate description of an immense variety of new forms, the scientific value of which will go without dispute. As the collections of the *Challenger* were for the most part made in the open oceans, the littoral zone, which would have furnished the larger proportion of Actiniæ was almost entirely neglected, and but one littoral species occurs in the list. As a rule the number of the Actiniæ decreases as the depth increases; they have not been observed at a depth of over 2900 fathoms, but the greater the depth the more the fauna was found to vary from that of the coast. Of the twenty-one forms from 500 to 3000 fathoms described, no less than six species are found to have undergone some extreme modifications of their tentacles, whilst a like phenomenon has never been observed in a single one of the forms of the coast fauna, which greatly exceed the deep-sea fauna in number. These alterations lie for the most part in the direction of transforming the tentacles into tubes and openings, and Prof. Hertwig connects this with the nutriment of these deep-sea forms, which is not of a nature to be captured by tentacles.

The Second Report is on the Tunicata, by Prof. Herdman. It is Part I., on the Simple Forms. The collection generally was found to be in a state of excellent preservation, and consisted of eighty-two species, which are referred to twenty genera. Of these, seventy-four of the species and nine of the genera are new to science, but it has not been found necessary to form any new families. The new genera are mostly instituted for very deep-sea species. In several instances the new genera have been of great interest, as they have demonstrated affinities between known forms, and have exhibited combinations of characters which in some instances necessitated a revision of the definitions of old genera, and even affected one's ideas with regard to the characters of the families. The new species are all beautifully illustrated in thirty-seven plates. The memoir has prefixed to it a history and bibliography of the group and a neat and well-written account of its anatomy, which is accompanied by an excellent series of woodcuts. So little is known as to the geographical distribution of the group that Prof. Herdman thinks any generalisation on this head would be of little value. A few facts of interest are, however, mentioned: thus the Tunicata are greatly more numerous in the southern than in the northern hemisphere, and they reach a maximum of abundance in the far south. As to their distribution in depth, the four families are found to have the following limits:—

The Molgulidæ range from the shore to			600	fathoms.
The Cynthiidæ	,,	,,	2600	,,
The Ascidiidæ	,,	,,	2600	,,
The Clavelinidæ	,,	,,	129	,,

Seven species were found at depths of from 2000 to 3000 fathoms.

Calcareous spicules are noticed as present in the tests of several species of the genera Culeolus and Cynthia. They are very different in the two genera, being irregularly branched and with smooth surfaces in Culeolus, while they are rod-shaped or fusiform, with their surfaces minutely echinulated in Cynthia. Neither of the two previously known genera in which the test is remarkably modified—Rhodosoma and Chelyosoma—were collected during the *Challenger* Expedition, but two of the new forms show notable peculiarities in the test, Pachychlœna having it greatly thickened all over, while *Hypobythius calycodes*,

Moseley, has a series of symmetrically placed nodular cartilaginous thickenings in the otherwise thin and membranous test. This Report of Prof. Herdman's may be regarded as almost a monograph of the Tunicates, and is a most valuable addition to our knowledge of this little known group of forms.

Volume VII. contains four Reports. The first of these is by Prof. Morrison Watson, on the anatomy of the Spheniscidæ collected during the voyage. The collection contained three or four adult specimens of each of the species obtained, preserved for the most part in brine, but in some instances in spirit, as well as a number of immature birds taken from the nest, together with eggs in various stages of hatching, preserved partly in spirits and partly in bichromate of potash. In the present Report only the anatomy of the adult birds is treated of; that of the young being reserved for a second part. Selecting *Eudyptes chrysocome* from Tristan d'Acunha as a standard, the anatomy of the other seven species is compared with it; thus in every section the anatomy of the standard species is given in detail, and then the variations met with in each of the others is appended. In those cases in which no variations are reported the anatomy of the forms was identical. The descriptive anatomy of the various systems of tissues seems to leave little to future investigators to record. In the section devoted to osteology, while treating of the bones of the anterior extremity, the author remarks that in several particulars the penguin's wing differs from that of other birds—movements of pure flexion and extension in the joints beyond the shoulder can scarcely be said to be possible; the articulations, however, admit of a very considerable amount of rotation, and consequently, instead of the limb being converted into an absolutely rigid paddle or oar, the rotation in question converts the wing into a screw-like blade, the curvatures of which are constantly varying in accordance with the amount of rotation which the forms of the different joints permit. Upon carefully watching a living specimen of Aptenodytes in the Zoological Society's Gardens, the author observed that the wing of the penguin is never used in the manner of a rigid oar, which would imply the simultaneous movement of both wings in the same direction in order to propel the bird. On the contrary, the wings were often and indeed usually brought into use alternately, much in the same manner as the pectoral fins of a fish, and in every movement of the wing wiry, screw-like curvatures, which are due to the rotation of the different segments of the limbs upon one another, are strongly developed. In fact, a constant screwing and unscrewing of the separate alar segments upon one another takes place simultaneously with the forward and backward movement of the organ as a whole.

From general considerations of the anatomy of the penguin, Prof. Watson concludes that these birds together form a natural group, every member of which is possessed of certain anatomical peculiarities which serve at once to associate it with its fellows and to separate it from the members of other groups which may more or less closely resemble the Spheniscidæ. From an anatomical point of view he would recognise but three genera—Aptenodytes, Spheniscus, and Eudyptes. The remarks on the characteristics of these genera and the limits of the species contained in them are among the most interesting in this Report.

As to the phylogeny of the penguins the author concludes that they form the surviving members of a group which had early diverged from the primitive avian stem, but that at the time when the separation took place, the members of that stem had so far diverged from the primitive ornithoscelidan form as to be possessed of anterior extremities, which, instead of forming organs of terrestrial, had become transformed into organs adapted to aërial progression, or true wings. If this view be correct, palæontological research may, in the course of time, disclose the existence of Spheniscidine remains which may enable us to trace the line of descent of the penguins of the present day from the original avian stem, and through it the relationship which exists between the modern Spheniscus or Eudyptes, with their separate metatarsal bones and aborted wings on the one hand, and the majority of modern birds, with their conjoined metatarsal bones and perfect wings on the other.

The geographical distribution of these birds is of great interest. They are entirely confined to the southern hemisphere, none of them straying north of the equator. Within this area their distribution is very extensive, reaching from the Galapagos Islands on the equator, southwards to the Antarctic Islands. Prof. Watson surmises that this distribution does not depend on temperature, but may depend on a relative abundance of the food supply (Cephalopods and Crustacea) found in the two hemispheres respectively; but the editor, Mr. J. Murray, in a footnote, says: "The penguins reach the equator only on the coasts of Chili and Peru. Now the Peruvian current from the Antarctic skirts along this coast, and takes a low temperature as far north as the Galapagos Isles; the temperature of the sea being there (equator) 62° to 66°, while in the middle of the Pacific (equator) the surface temperature is 81° to 88°. Temperature, therefore, most probably has something to do with the limitation of the geographical distribution of the Spheniscidæ."

The second memoir is by Dr. F. Buchanan White, on the Pelagic Hemiptera collected during the voyage. These, the only truly pelagic insects, belong to the genera Halobates and Halobatodes. The first of these was founded sixty years ago by Eschscholtz for three species taken during the well-known voyage of Kotzebue round the world. But few species are known, and they are very rarely to be found in collections, though they seem to be abundantly distributed in tropical seas. Their structure would seem to indicate that they are archaic forms of great antiquity, and as doubtless many species yet remain to be discovered, it is to be hoped that some one with the will and the opportunity will be found to turn their attention to the group. In the meanwhile Dr. White has in this Report given a detailed account of the literature of these genera, followed by an account of the anatomy and description of the genera and species. Of the genus Halobates he describes eleven species, of which three were first described by Eschscholtz, one each by Templeton and Frauenfeld, and six for the first time in this memoir. In his remarks on the species we notice that, after a very bad fashion adopted by some entomologists, these are alluded to under their trivial

names only, thus: "according to Frauenfeld, *micans* differs from *willerstorfii*." This is the only departure from the ordinary rules of nomenclature that we have as yet noticed in these Reports, and we call attention to it in the earnest hope that it will not occur again.

Species of Halobates are recorded in Mr. Murray's journal as found twenty-one times in the Atlantic between latitudes 35° N. and 20° S., and thirty-eight times in the Pacific between latitudes 37° N. and 23° S. The majority of the specimens taken by the tow net were dead when brought on board, but some were taken alive and were observed skimming over the surface of the water in the glass globes. On one occasion a species was seen to dive. Of the species of Halobates now known, five occur in the Atlantic, but one only is restricted to that ocean, though the headquarters of another appear to be there. Six species, of which two are peculiar, occur in the Indian Ocean west of long. 100° E., while to the east of this, and chiefly in the West Pacific, eight species occur, of which four are restricted to that region. But taking the West Pacific and Indian Ocean together, we find that nine out of the eleven known species occur there, and five nowhere else. Of Halobatodes *H. lituralus* occurs in the Chinese Sea, *H. compar* is from India, *H. stali* from Ceylon. All the species are figured on three plates.

The Third Report is by Prof. Allman, on the Hydrozoa. Part I. Plumularidæ. Of the Hydroids, a large number of exotic species have been recently described, notably the collections made during the exploration of the Gulf Stream, and during the expedition of H.M.S. *Porcupine*, by Dr. Allman himself. But to this number the collection brought home by the *Challenger* makes a large and valuable addition. Of this collection the family of the Plumularidæ forms a considerable proportion. Only one form can be identified with a species occurring in the European seas. This species, *Cladocarpus formosus*, was dredged by the *Porcupine* from the seas lying to the north of Scotland, and by the *Challenger* from the seas at Japan. It is a well-marked species, and the great distance between the Atlantic and Pacific stations, without any intermediate station having been discovered, is a remarkable and significant fact. By far the larger number of the forms brought home by the *Challenger* consist of species new to science, while among these a considerable number have had to be assigned to new genera. Many of the species are of great interest from the light they throw on the external morphology of the group, and from the aid which they afford towards a philosophical conception of the significance of parts otherwise enigmatical. The Report is prefaced by some introductory remarks on the general morphology of the Plumularidæ. While not yet possessing the data necessary for a complete exposition of the geographical distribution of this group, it may be generally asserted that it attains its greatest development in the warmer seas of both hemispheres, and that in tropical and subtropical regions it has its maximum in multiplicity of form, in the size of the colonies and in individual profusion. The dredgings of the *Challenger* and of the United States Exploration of the Gulf Stream would further seem to point to two centres of maximum development within the area thus indicated—an eastern centre, which is situated in the warm seas around the Philippines and other islands of the East Indian Archipelago, and a western centre, which will be found in those which lie around the West Indian Islands and bathe the eastern shores of Central and Equinoctial America. In bathymetrical distribution the Plumularidæ present considerable variation. Among the species described some are quite littoral, having been dredged from depths ranging from between 8 and 20 fathoms. The greater number, however, have been obtained from depths between 20 and 150 fathoms, while three species, *Aglaophenia filicula*, *A. acacia*, and *Polyplumaria pumila*, are from a depth of 450 fathoms. The striking and beautiful genus Cladocarpus consists of eminently deep-water forms, and of the two species described, one—*C. formosus*—was obtained in the Japan seas from a depth varying between 420 and 775 fathoms; the same species from the north of Scotland was found at depths of from 167 to 632 fathoms. The second species—*C. pectiniferus*—was dredged off the Azores from 900 fathoms, being the greatest depth from which any Plumularidan is known to have been obtained. This Report is illustrated by twenty plates.

The last Report in this volume is on the genus Orbitolites, by Dr. W. B. Carpenter, with eight beautiful plates by Mr. George West, jun. Some thirty-six years ago Dr. W. B. Carpenter received from Prof. Edward Forbes some small discoidal bodies which had been dredged between 1842 and 1846 by Prof. J. Beete Jukes on the coast of Australia, with the hint that these were probably the Marginopora of Quoy and Gaimard. From this time to the present Dr. Carpenter has made a pretty constant study of these interesting Foraminifers, and he gives us a highly instructive account of the views held from 1823 by the various authors who have written on the genus, from the strange misconceptions of Ehrenberg to the accurate descriptions of Prof. Williamson, who first clearly determined the close affinity between Orbitolites and Orbiculina, thus disposing of the Bryozoic doctrine of Ehrenberg and relegating these organisms to the Foraminifera. As the final result of Dr. Carpenter's laborious researches on this group, he concludes that while the ordinary notions of species will not apply to it any more than it will to any of the Foraminifera, still particular types of form are transmitted with marked genetic continuity, and he distinguishes four very well marked types of Orbitolites, around which the entire assemblage of specimens collected over a very wide geographical area, and from a great bathymetrical range, can be grouped without difficulty. Treating of the subject of descent, the author declares that "it seems to him that the evolution of this type from the simplest monothalamous Milioline has taken place according to a definite plan, of which we have the evidence in the wonderful uniformity and regularity of the entire sequence of developmental changes, whilst we are entirely unable to account for those changes without attributing to the subjects of them a capability of being affected by external agencies or modes so peculiar as to indicate a previous adaptation."

From an editorial note prefixed to this volume we learn that the various large incidental collections of terrestrial forms, such as insects, spiders, reptiles, &c., will not have any detailed reports published concerning them, but that they will be referred to in the narrative of the cruise, the first volume of which is announced for 1884.

OUR BOOK SHELF

Elementi di Fisica. Vol. IV., Elettricità e Magnetismo. By Prof. Antonio Ròiti. (Florence, 1883.)

SURELY, and not slowly, the views of Thomson, Maxwell, and the modern electricians generally are finding acceptance throughout the Continent. The absolutely unanimous acceptance of the British Association's system of electrical units since the indorsement of that system by the Paris Congress of 1881 has proved the immense gain to the electrical world of having a uniform means of expressing electrical quantities, and has compelled electricians not only to read but to comprehend the writings of the pioneers of this most important reform. The work now before us for review, though professing to be but a text-book for use in the lyceums and schools of Italy, gives ample evidence that its author, Prof. Ròiti, of the Royal Institute of Higher Studies in Florence, is not only abreast of all the latest developments of electricity, but that he has mastered the theory also. Few text-books of its size have we seen that will compare favourably with Prof. Ròiti's little volume of 356 duodecimo pages. The faults which have been hitherto so conspicuous in most of the Continental text-books on electricity are in this work conspicuously absent. As an example we may refer to the author's treatment of the relation between the capacities, potentials, and charges of similar conductors. The elementary theory of the magnetic shell and that of the mutual potential of two magnetic shells are neatly expounded in pages 131 to 133. The absolute electrometer and the quadrant electrometer of Sir W. Thomson are both described, and illustrative figures given. The system of absolute and derived (C.G.S.) units, and that of the practical units of electric quantities based upon them, are explained at length on pages 204-5. There is a short chapter on the electric light, and another on electric motors, in which the *anello elettromagnetico di Pacinotti* is described, the author remarking with emphasis that it contained the germ of almost all the machines by which the marvellous strides recently made in the applications of electricity have been achieved. The experiments of Deprez at Paris on the electric transmission of power, and the economic questions involved are also touched upon. Crookes's researches on "radiant matter" are mentioned and illustrated. Amongst points of novelty may be mentioned Pellat's method of measuring the electromotive force due to polarisation, which has not yet, we believe, found its way into any English text-book. Two points of criticism we have to offer in conclusion. The first is that the author defines electric *tension* as identical with the electric *force*, equal to 4π times the surface density of the charge, instead of defining it, in the sense of Faraday and Maxwell, as the stress on the dielectric, which is proportional to the square of the surface density, and therefore proportional also to the square of the electric force or electromotive intensity at the point of the surface considered. The only other complaint we have to make of the work—and this does not detract greatly from its value—is that the author does not acknowledge the sources from which some of his descriptions and cuts are taken. S. P. T.

Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, wissenschaftlich dargestellt in Wort und Bild. Erster Band, Protozoa. Neu bearbeitet von Dr. O. Bütschli. (Leipzig and Heidelberg: C. F. Winter, 1880-83.)

THE first nineteen parts of this new edition of vol i. of Dr. Bronn's well known and important work on the classes and orders of animals, nearly completing the volume, prove that Prof. Bütschli has spared no pains to keep it up to the most modern investigations of the Protozoa. In no one division of the animal kingdom has observation gone so hand in hand with discovery as in this, the lowest of her classes. Glancing at the portion treating of the Gregarinida, what strides have been made in our knowledge of these forms within the last ten years. Adopting Leuckart's titles for the class of Sporozoa, under which are the sub-classes Gregarinida, Coccidia, Myxosporidia, and Sarcosporidia, we find 137 pages and eight plates crowded with figures devoted to a sketch of the characteristics of the class with diagnoses of the genera and the number of species, and references to the places where fuller details of these latter will be found. The illustrations are clear and effective, and copied from every available source. The bibliography appears to be well to date, and this volume when complete will be an indispensable handbook for the student of the lower forms of animal life.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

"Elevation and Subsidence"

THE view that the glacial subsidence was due to the pressure of the accumulating land ice, has been accompanied with the corollary that subsequent elevation was due to the removal of this pressure by the melting of the ice; but though I think the first is true, the corollary is not so, in England at least.

In my memoir "On the Newer Pliocene Period in England" (*Quart. Journ. Geol. Soc.* for 1880, p. 457, and 1882, p. 667), I have endeavoured to show how the inclination of this country changed during the progress of the major glaciation, and the flow of the land ice from the mountain districts to the sea altered in accordance therewith, as well as pointed out (p. 709) the connection of this change of inclination with the accumulation of the land ice on the mountain districts; but I have also traced in detail in it how the east side of England rose to an extent that brought Norfolk and Suffolk from a submergence of more than 300 feet to their present level at least, and Essex proportionately so, while the land ice continued to push over the sea-bed of sand and gravel, as this rose into land, covering it with its moraine, until by this rise the easterly movement of the ice was arrested, while the west and south of England still remained to a great extent submerged. Since that memoir was published, Mr. David has in the same journal described the glacial clay which represents the moraine of the Welsh land ice in East Glamorganshire, itself *uncovered* by any marine deposit, as covering beds of stratified sand and gravel, which, from their containing many chalk flints, can be only the bottom of the antecedent sea, as low down as 80 feet above Ordnance datum. When this is compared with the evidence of more than 1300 feet of submergence afforded by the shell bearing gravels of North Wales; of 700 feet afforded by the Gloucestershire gravels to the east; and of between 500 and 600 feet afforded by the gravels of Devon to the south of Glamorganshire, it becomes evident that the amount of rise which took place in the west of England before the land ice began to retreat was even greater than in East Anglia. It is to subterranean movements engendered by this pressure, and not to its removal, that the rise in England seems to me to have been due; and I have given several sections in this memoir in illustration of the abrupt and violent character of the upthrows connected with it.

Although in this memoir I remarked upon the coincidence of the westerly increment in the great submergence with the augmenting quantity of the land ice on Cumberland, Westmoreland, and Wales, as the major glaciation went on, yet this coincidence between augmenting land ice and submergence is, I now see, more complete than had then occurred to me; for though I described the evidences that show the passage from the Crag to the glacial marine beds of Norfolk and Suffolk to have been accompanied by a northerly subsidence which submerged the valley of the Crag river, in the north of the former county, while the other extremity of its estuary (in East Suffolk) was elevated, so that islands formed of Crag beds came there into

existence, around and up to which the earliest glacial marine accumulations of sand and shingle were bedded, and which, as subsequent southerly and westerly subsidence ingulphed all but the highest downs of the south of England, eventually spread over these islands, yet I did not connect this first movement with the pressure of the land ice. I have since, however, perceived that this connection exists; for, as the Glacial period came on, the precipitation must necessarily, on account of latitude, have taken more exclusively the form of snow in Scotland before it did so in Cumberland and Wales; and, by thus accumulating land ice earlier in Scotland, caused this northerly subsidence. As the cold increased the precipitation in the form of snow reached its maximum in Westmoreland and Cumberland, and yet later somewhat in Wales; and as it did so, the pressure of the land ice engendered by it turned the depression increasingly in those directions, so that eventually all England, save the highest downs, and even the lower ends of the river valleys of North-Western France became submerged proportionately to their contiguity to the foci of pressure. These increments of depression I have in this memoir traced by more than one train of evidence, and shown how this change of inclination, by diverting the directions taken by the land ice to the sea, changed also the character of the materials of which the resulting morainic clay is made up, and so gave rise to those Upper and Lower clays of the major glaciation in Yorkshire, which have been seized upon to support the hypothesis of alternations of climate during that glaciation.

The connection between the augmenting weight of the land ice and subsidence seems to me so clear, that I cannot but think that American geologists have fallen into an error, in regarding the Champlain period as belonging to the wane of the great glaciation, instead of to its culmination. It seems to me that although the increasing volume of the land ice in the Lake (or St. Lawrence) basin caused this ice at its western extremity, where the parting between the two basins is very low, to invade the upper part of the great Mississippi basin, yet its weight where thickest—that is to say, towards its eastern extremity, which was that of greatest snow precipitation—so pressed this extremity down that the seaward termination of this ice in the Gulf of St. Lawrence retreated before the greater depth of sea there which thus resulted, and so allowed the sea to penetrate to Montreal and Lake Champlain, near the former of which places the remains of its inhabitants have been left at an elevation of about 600 feet.

With all this, however, we must not be led into regarding all movements of subsidence as a result of increasing accumulations, whether of sediment or otherwise; for such is evidently not the case, though to instance this would lead me beyond the object of this letter. SEARLES V. WOOD

Martlesham, near Woodbridge, October 11

THE above remarks require but little comment, and chiefly tend to show that Mr. S. V. Wood attaches increased importance to the idea that weight produces subsidence. He speaks of elevation commencing before the retreat of the glaciers, but that they would be enormously lightened before retreating is a fact that I can hardly suppose he has overlooked. In ascending the Jungfrau many years ago, when the Swiss glaciers were diminishing, I crossed from the Grindelwald on to the Aletsch, and had to descend a cliff of nearly vertical ice, which my recollection tells me was some sixty feet high, in order to pass from one to the other. The difference in level was caused by the extra rapid melting of the Aletsch, owing to its more southern aspect and exposure to the Föhn wind. This was at the head of the glacier, and the melting was much more rapid lower down, though the superficial area had not contracted to any appreciable extent. This loss of weight would lead to elevation long before the disappearance of the ice. J. STARKIE GARDNER

Snake Bite

I WAS an eye-witness to the following:—My brother was walking within a field of the Land's End when he stooped to pick up a large snake, apparently nearly a yard long, which bit him on the thumb. The bite became very painful in a few moments, and we realised for the first time that it was poisoned. In less than five minutes he was in the hotel and swallowed half a pint of neat brandy, and soon after some ammonia and water, without any effect. The wound had been well sucked and was steeped in ammonia, but the arm soon swelled to the size of the body, and the swelling began to extend down the ribs. The thumb was lanced while immersed in hot water, and the result was similar to the first gashes in a shoulder of mutton, the exposed flesh being dark mulberry colour, and not a drop of blood flowing. He recovered in seven or eight days, but was weak for some time. J. S. GARDNER

Park House, St. John's Wood Park, N.W.

The Observation of Meteors

ACCOUNTS of large meteors form a frequent subject of correspondence in the columns of scientific journals, but it is not often the case that the descriptions of these phenomena are sufficiently exact to be valuable for purposes of calculation. Rough estimates of the direction and position of flight are of little utility, and the vague statements often made occasion an endless source of difficulty in the satisfactory reduction of results. It is true that observers of fireballs are generally taken unawares by the suddenness of the apparitions, and that the visible paths are seldom to be noted accurately. Before the observer collects himself to record the facts of the display it has disappeared, and he has to rely solely upon the impressions retained in his memory.

But, notwithstanding this drawback, the observations of large meteors as published from time to time would possess far greater scientific value if observers would attend more scrupulously to that most essential detail, the *direction of flight*, and express it by some method of uniformity. Sometimes we find the path vaguely stated as being from "east to south," without any attempt to estimate the altitude of the beginning and end points of the course. On other occasions a meteor is described as passing above or below certain stars or planets. The latter method, though an improvement upon the former, is to some extent indefinite, and therefore unsatisfactory, as giving unnecessary trouble to those who undertake the reduction of such materials. For instance, a meteor is observed early in August, 1881, shooting from "some distance below Saturn towards Comet B." Now in reducing this account troublesome references have to be made to find the places of the two objects on the dates mentioned, and then we are left to guess at the "distance below Saturn" implied in the description. These objections would disappear, and the comparison of observations be greatly facilitated, could observers be induced to give the right ascension and declination of the beginning and end points of the visible paths. These elements admit of ready determination by projecting the observed flights upon a star chart or celestial globe and reading them off. Even in cases where the observations are uncertain, the observer should fix the path according to this method as nearly as possible, for it is manifest that it is infinitely preferable to the vague and often worthless attempts to guess altitudes, compass bearings, &c., and, moreover, it renders the after comparison of observations a work of greater facility and precision.

Though the direction of flight is the all-important element to be determined by meteor observers, there are some minor points which should also be carefully recorded. The time of appearance, brightness, approximate duration, and whether accompanied by phosphoric streaks or spark trains, are each important in their way, and must be stated whenever feasible. If this were done more systematically, the observations of fireballs would acquire additional value, and may quite possibly develop some new facts either as to their appearance or origin.

Bristol, October 22 W. F. DENNING

"Partials"

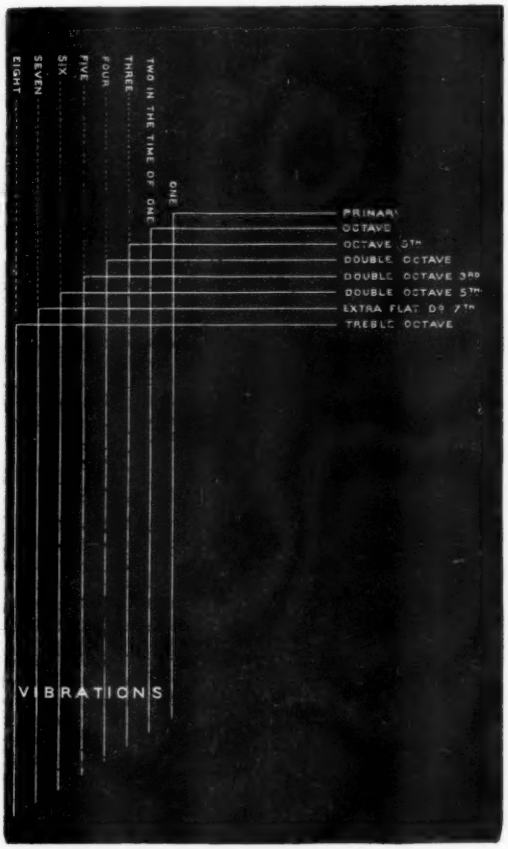
IT is a well known fact that no musical sound is produced alone, but the instant it is sounded a series of other sounds springs from it, and always in a certain order and ratio. Next to the primary tone, the octave is heard, then the octave fifth, the double octave, the double octave third, the double octave fifth, the extra flat double octave seventh, the treble octave, and so on. The origin of these "partials" has long been an interesting study, and a solution has occurred to me which I think is the true one.

We have the fact that an object seen by the eye for ever so short a time leaves its impression on the optic nerves about the eighth of a second *after it has passed away*. By analogy it seems highly probable that all our nerves, including those of the

ear, retain impressions made upon them for a momentary period after the cause has ceased to act. If this surmise is correct, then the following would ensue. All musical tones being produced by vibrations striking upon the ear in rapid succession, the first vibration would continue to be felt during the strokes of a number of succeeding vibrations.

The second vibration coming upon the ear before the first ceased to be felt would produce the effect of two in the time of one, making the octave sound.

The third would produce the effect of three in the time of one, making the octave fifth; the fourth, four in one, the double octave; the fifth, five in one, the double octave third, and so on,



the order *exactly corresponding with that in which the partials are heard*.

Of course while the successive strokes occur the first is becoming fainter in effect, and thus each partial in the above order is heard with fainter intensity.

What the first vibration is to the second and its successors the second vibration is to the third and its successors, and thus the series of partials is kept up as long as the primary tone exists. This also accounts for the strong partials heard in the rough vibrations of the harmonium and the few partials heard from the smooth tones of the flute. W. C. JONES

Chester, October 18

The Green Sun

ON Sunday, September 9, the residents in Colombo, while enjoying their evening stroll on Galle Face, were astonished by a strange appearance in the heavens. The sky was cloudy, and frequent squalls were passing over the sea, one of which just touched Colombo. As soon as it was past, the sun emerged from behind a cloud, of a bright green colour. It was then about 10° above the visible horizon. The whole disk was distinctly seen, and the light was so subdued that one could look steadily at it; indeed I should say its intensity was scarcely half that of the full moon. The same phenomenon was also observed on Monday and Tuesday. Wednesday was overcast, and I have not heard of any observations being made; and on Thursday the sun had resumed its normal appearance. I was not in a position to observe it in the morning; but from reports from other parts of the island I learn that the sun appeared green at its rising, and afterwards changed to blue, like the flame of sulphur, giving little light till it had attained an altitude of about 20°, when it could no longer be watched with the naked eye. During the day the light had a bluish tinge; and in the evening the same phenomena were repeated in inverse order. The moon also, to some extent, was affected in the same way.

Can any of your correspondents give an explanation of this? It has been suggested that a convulsion in the sun may have given prominence to vapours emitting a green light; but to me it seems more probable that the cause is to be sought in the upper strata of the earth's atmosphere. Can it have any connection with the recent volcanic eruption in the Straits of Sunda?

Colombo, September 19 W.

IN a clear sky, as the disk of the sun sinks down beneath the horizontal line of the ocean, the parting ray is a brilliant emerald green. I have occasionally, but not often, had the pleasure of seeing this interesting phenomenon, as the clear atmosphere has to be accompanied with a cloudless region of the sky where the sun is setting. The same effect is not produced by the sun setting behind a distant bank of clouds. Probably the first ray from the rising sun would be the same unexpected colour.

Week St. Mary Rectory, Cornwall G. H. HOPKINS

Pons' Comet

THIS comet already has a tail, though a very faint one. With a 4½-inch refractor I traced it last night to a distance of 20′ from the nucleus, at a position angle of about 75°.

October 26 T. W. BACKHOUSE

Earthquake

SEEING in your last issue (vol. xxviii. p. 623) that Mr. Cecil describes two distinct tremors of earthquake felt here by him, I write to say that the same phenomena were experienced by myself. I was disturbed in the night by what I mistook for an alarum going off, but found that it was a glass on my water-bottle vibrating violently. After a short pause the glass again vibrated. I found next morning that I could exactly reproduce this sound by shaking the washing-stand. I have never known the washing stand to tremble before, even in a gale.

H. HOWARD CRAWLEY

Pine View, Bournemouth, October 29

STUDIES MADE ON THE SUMMIT OF THE PIC DU MIDI WITH A VIEW TO THE ESTABLISHMENT OF A PERMANENT ASTRONOMICAL STATION[1]

THANKS to the indefatigable zeal of General de Nansouty and the engineer Vaussenat, a meteorological observatory has already been erected on the Pic du Midi. After visiting the place with the Director of the Higher Instruction on the occasion when this observatory was handed over to the State, Admiral Mouchez came to the conclusion that it might be possible to establish an unrivalled astronomical station on the summit, which is now perfectly habitable. In the month of August last he did us the honour of requesting us to study on the spot the advantages and possible drawbacks attending an installation made under such exceptional conditions. The details of our observations will form the subject of a special memoir far too extended for insertion in the *Comptes Rendus*. For the present our remarks must

1 Note by MM. Thollon and Trépied, from *Comptes Rendus* of October 15.

be limited to a simple communication of the more interesting results obtained by us from August 17 to September 22.

On reaching the summit of the Pic du Midi (2877 metres), where the barometer maintains a mean height of 538 mm., everything presents itself to the observer as if the density of the veil formed above him by the atmosphere were diminished by about a third. The aërial region left behind him being unquestionably the most charged with mist, dust, and aqueous vapour, he may expect to find at once more light and less diffusion. Thus, during the mornings of September 19 and 20, by masking the sun with a screen held at some distance, and exploring the surrounding space with a small spectroscope with an aperture of 0·02m., we were able to observe the planet Venus at a distance of 2° from the solar disk. We could even subsequently distinguish it with the naked eye. But what most surprised us was the marvellous definition at this station. The limb of the sun projected on the slit of a spectroscope showed a spectrum with a boundary as sharp as if produced by a punching machine. We can positively state that we never elsewhere saw anything similar either at Nice, in Italy, Algeria, or even Upper Egypt. We should add that this complete absence of undulation was noticed only in the morning. After the slopes of the mountains had been exposed for several hours to the heat of the sun, the undulations were produced as they are everywhere else, and even became excessive for the rest of the day.

During clear nights, using a telescope with an aperture of 0·16m., and a reflector by Henry of 0·20m., we found the perfect definition observed in the case of the sun in the morning reproduced in the case of the moon, planets, and stars. Under such conditions observations of extreme precision could certainly have been obtained.

For the study of solar physics we had set up the horizontal telescope and the large spectroscope which we usually employ. On observing the solar spectrum at a favourable moment, it seemed streaked in its entire length with a considerable number of fine lines, some bright, others dark, at a mean distance of 3″ of arc from each other. They certainly belonged to the solar image, for they followed all its displacements, and they could have arisen from the granulations of the photosphere alone. Under the same conditions, that is, when the images were perfectly still, the hydrogen bands C and F had no longer any sort of continuity, but seemed formed of distinct bright and dark fragments, of the same magnitudes as the intervals between the lines.[1] This phenomenon was observed not merely at certain times and places, but constantly over the whole surface of the disk. We feel satisfied that the chromosphere presents a system of granulations analogous to that of the photosphere. The two systems thus superimposed become separated in the spectroscope, yielding, one a continuous, the other a linear, spectrum, and blending together in the telescope as on a photographic proof. If this chromosphere, thus rendered visible on the full disk, happened to be traversed by a protuberance, the band C increased in luminosity and for a greater length. By giving sufficient breadth to the aperture, we were then able to observe the protuberance itself, as when on the edge, although naturally with less brilliance, and foreshortened. Nor is this the first instance of protuberances thus observed on the full disk. On this subject the delicate observations of Young and Tacchini are well known. But instead of being accidentally visible, instead of being produced only under special circumstances, as for instance in the neighbourhood of a spot or on the bridge of a spot in process of segmentation, these phenomena were constant for us with varying degrees of intensity, and under the sole condition of using an image entirely free from undulations.

[1] These phenomena referred to by Messrs. Thollon and Trépied were observed and recorded in England under exceptionally fine atmospheric conditions during the last sunspot maximum.

The observations made outside the edge of the solar disk were no less pregnant with results. We know that in the spectrum of the chromosphere there are eight lines always visible under ordinary conditions. On the Pic du Midi, during the five days when we were able to make our records at favourable moments, we saw the number of these bright lines always visible increased to over thirty in the portion of the spectrum which is comprised between D and F. Here we subjoin a table of the wavelengths of these lines :—

5533·6	5273·2	5204·8	5122·6
5525·8	5258·9	5199·5	5114·4
5469·9	5254·3	5196·9	5112·1
5361·5	5252·2	5183·0	5087·0
5324·3	5248·8	5172·0	5029·8
5318·7	5233·9	5168·3	5017·9
5292·4	5225·6	5166·7	4983·6
5283·1	5207·4	5147·0	4923·0
5275·0	5206·8	5130·2	4882·9
			4854·2

It will be seen that, at the altitude at which our observations were made, an approach was made to the conditions prevailing during a total eclipse.

To resume. The observations we were able to make on the Pic du Midi during the five weeks of our sojourn on its summit justify us in concluding that science will gain much by the completion of the astronomical station begun by the directors of the Paris and Pic Observatories. Here we should have a permanent establishment always open to *savants* wishing to undertake special researches. To mention those points only towards which our attention was mainly directed, we are of opinion that good opportunities would here be found of furthering the solution of many problems connected with solar physics and the spectral analysis of the stars.

THE WHEAT HARVEST OF 1883

THE public must be somewhat puzzled with the divergent opinions of authorities upon the yield of the wheat crop of the present year. On the one side, for example, stands Sir John Lawes with his accurate balances and wonderful wheat field, which experience has taught him usually proves a fair criterion of the yield of the English crop. On the other side is arrayed a somewhat formidable party, which we may take as well represented and led by the very able article in the *Times* of Saturday last, headed "The Result of the Harvest." To put the matter briefly, there is a difference of opinion as to whether we have reaped an average crop or an under-average crop of wheat. And there is also a good deal of difference in opinion as to what an average crop is. The point of greater interest no doubt to us is whether we have just secured an abundant harvest or not. It is a point of very great importance not only intrinsically but as a matter of opinion. If business men believe that our national wealth has been recently increased by an unusual augmentation of our food supply, they may make this opinion a basis for enterprise or speculation. If the opinion which prompted them to action should prove a false one, the results would be inflation, panic, and loss. It is therefore very essential that public opinion should be guided in a right direction upon this important point. Any person who has read our leading newspapers carefully upon the subject of harvests for a series of years will probably have observed a tendency to over-estimate production. The prospect is usually depicted *couleur de rose*, and the public is congratulated upon its harvest prospects, while practical farmers remain in doubt as to the yield of their cornfields. Of one thing we may be certain—that wheat needs heat. The average temperature of our islands is scarcely suitable to the wheat plant, which is rightly viewed as somewhat exotic in its requirements. A slight elevation above the sea-level, or a slight decrease in solar heat, invari-

ably lowers the yield of wheat. Properly read with regard to its distribution throughout the season, the temperature of the summer months ought to guide us to a judgment with regard to the probable yield of wheat. It is the same with regard to wine. Good wheat and good wine years run together. 1868, 1870, and 1874 will probably all continue to be remembered as good wine years, and they are well known as among the best wheat years of the present half-century. In judging as to the effects of temperature upon the wheat crops, we must not only take average temperature but fluctuations between night and day. A single cold night may do incalculable damage, and a few cold days at blooming time may do much to blight a wheat-grower's prospects. Those who watch the weather closely will usually lay the foundation of a sound judgment upon wheat prospects. We require, first, a good seed time; second, a dry March; third, a hot June, July, and August. So much for the weather. We require also a good "plant," *i.e.* plenty of young wheat plants uniformly scattered over the surface. The growing crop must be fairly free from those unaccountable visitations known as "blights," both insect and vegetable, and if we can secure these good conditions we reap a good wheat crop. Let us then endeavour to apply these rules to the actual state of things during the months between seed time of 1882 and harvest of 1883, and let us glance at the various opinions expressed as to the yield of wheat for the present year in the light of these facts. First, then, we passed through a period of incessant rainfall during the time when farmers usually sow their wheat. A worse seed time we have rarely experienced. Constant rain and destructive floods were the characteristics of October, November, January, and February last. Now we owe to Sir John Lawes, in a great measure, the knowledge of the fact that a wet winter washes out that element of fertility which of all is the most important, namely, the nitrates. Here then we have to record a very wet winter, in which seeding was interrupted and nitrates were washed through into the drains and subsoil, and that to an unusual degree.

The consequence was that in the spring a thin plant was the rule upon all stiff soils. After this the wheat improved under the influence of a singularly fine spring, and farmers rejoiced in the opportunity afforded them to get on with their root cultivation. Unfortunately this state of things did not last. At the most critical period for the wheat crop summer forsook us. The nights became bitterly cold in June, and a continuation of wet weather set in which lasted almost up to harvest. Accompanying this untoward state of affairs were blights, and the ears became greatly affected with wheat-midge, smut, and ear-cockle, so that wheat-growers became sensible that their main crop was in extreme danger of ruin, and that before the papers began to publish their estimates.

This feeling among wheat-growers was quite general, as they knew that empty ears could not lead to full measures. Examination of the ears just before harvest showed clearly that small and shrivelled grains were only too common, and that many of the florets were barren. Accordingly crops were valued low, and the results from the threshing machine are bearing out the wisdom of these low valuations. As to Sir John Lawes' estimates, based on the experimental field at Rothamsted, no one knows better than Sir John that this coincidence between his average yield and that of the country generally must be liable to be upset by local disturbances. As a criterion of the harvest Sir John Lawes' field may be useful, but certainly cannot be infallible. A local frost, a local hail-storm, a local loss of plant, or faulty cultivation, must be always liable to affect any field and rob it of its general average character when compared with the harvest of millions of other acres. All this is simple truth, and in this season we are inclined to think that Sir John's field "told a flattering tale." The opinion of the writer of the present article is based, first, upon the meteorological conditions to which the wheat crop was exposed during its growth. Secondly, upon his own experience as a grower. Thirdly, upon information obtained from other growers, and from observation and reading.

He has come to the conclusion that the wheat crop of 1883 is below an average, and will be disappointing to the grower. Not only was the crop subjected to many bad conditions during its growth, but a large proportion of it was badly harvested, and is now in wretched condition. If we are not deeply disappointed with the 20 to 26 bushels of wheat per acre which our own liberally treated crops are yielding of *marketable* corn, it is because we have never expected more since those frosty nights of last June, when we resigned our hopes of a good wheat crop. The subject is almost too long for treating in a single article, and we must leave it here. If space had permitted, we should have entered upon the question as to what constitutes an average crop of wheat—a point upon which we appear to be in a state of great ignorance, unless we are to believe that an average which thousands of our best farmers have not been able to touch for the last ten or twelve years is that of the entire country with its millions of badly cultivated acres. This we cannot admit, and after a careful study of the estimates made as to average yield in various counties, we are driven to the same conclusion as that of the writer to the *Times* last Saturday, namely, that little reliance is to be placed upon them. Average, over-average, and under-average are somewhat vague terms, and difficult to fix. We can, however, base an opinion upon the fact that cheerless, cold, and wet summers that are unfavourable for fruit, bees, and vines, or even to pleasure parties, lawn tennis, and picnics, are not going to be favourable to wheat-growers. We have not touched upon barley and oats, but are prepared to allow that circumstances have been more favourable towards these crops than towards the most important cereal.

JOHN WRIGHTSON
College of Agriculture, Downton, Salisbury

ON A NEW METHOD OF SINKING SHAFTS IN WATERY, RUNNING GROUND

WHEN an attempt is made to sink a shaft in very watery deposits of gravel, sand, and mud in the ordinary way—that is, by digging out the solid matter by hand and pumping the water to keep the bottom dry—it is found that, after a certain depth has been reached, the current of water which flows up through the bottom brings solid matters along with it as fast as they can be removed, and further downward progress is then completely arrested. Under these circumstances it is necessary to resort to certain special methods of sinking, two of which have been hitherto employed with more or less success. According to one of these methods the shaft-lining consists of an air-tight iron cylinder fitted with an air-tight cover. When the excavation is continued below the natural level of the water, compressed air is forced into the interior of the shaft so as to drive back the water and leave the bottom dry. The workmen can then stand in the bottom and remove the solid matter by hand as easily as if the ground had been naturally free from water. The lining sinks downward as its lower end is laid bare, and is lengthened at the top as required. The pressure of the air is gradually augmented as the depth increases, but unfortunately this process cannot be carried beyond three atmospheres without prejudicially affecting the health of the workmen. When the depth of the watery running ground surpasses the limit represented by a pressure of three atmospheres, it is necessary to resort to the second method. In this case the water is allowed to stand at its natural level in the shaft, and the solid matters are removed from the bottom by a revolving dredger. The lining or casing consists of a cylinder of masonry or iron

provided with an iron shoe or cutting ring, and sinks downwards at first in virtue of its own weight, being lengthened at the top as in the previous case, but after a time it generally becomes necessary to force it down by the pressure of screws, assisted by the blows of an instrument resembling a pile-driver. When it cannot be made to sink deeper, another similar cylinder of smaller diameter is introduced into its interior, the same series of operations are again gone through, and so on until the solid ground is reached.

Simple as the last described process may appear, its application is sometimes attended with difficulties of almost incredible magnitude. As an example we may mention two shafts which were sunk through about 400 feet of the kind of ground in question at the Colliery Rheinpreussen, near Ruhrort in Germany. One, begun in 1857, was not finished after more than eighteen years' constant perseverance; while the other, begun in February, 1867, was only completed down to the solid ground in June, 1872.

The new method invented by Herr Poetsch is described by Bergassessor G. Kohler in the *Berg und Hüttenmännische Zeitung*, No. 38, xlii. *Jahrgang*, September 21, 1883. It consists in freezing the water contained in that portion of the running ground which occupies the position of the intended shaft into a solid mass of ice, and then sinking through it by hand without having to pump any water. To this end a preliminary shaft of larger dimensions than the intended shaft is sunk down to the natural level of the water. A number of vertical bore-holes about one metre apart are then put down round about its sides at the bottom, so that they pass through the ground just outside the lining of the intended shaft. Others are put down within the area of the intended shaft, and one is put down in its centre. All of these bores are continued down to the bottom of the running ground. They are made by means of the sand-pump, and are lined with sheet-iron tubes in the usual way. A circular distributing pipe with small copper tubes branching from it is placed at the bottom of the preliminary shaft. One copper tube extends to the bottom of each bore-hole, and each tube is provided with a stopcock. At the surface are several ice-making machines of the Carré type. The liquid intended to circulate through the bore-holes and effect the operation of freezing consists of a solution of the chlorides of magnesium and calcium, whose freezing-point lies between $-35°$ C. and $-40°$ C. By means of a small force-pump it is made to circulate at such a rate that it leaves the cooling-trough with a temperature of about $-25°$ C. It descends into the distributing pipe, passes through the copper tubes to the bottom of the bore-holes, ascends outside the copper tubes to the top of the bore-holes, finds its way into a collecting-tube, reascends to the surface, passes through the cooling-trough, and then commences the downward journey again.

Herr Poetsch estimates that, under ordinary conditions—that is, when the outer ring of bore-holes can be made in the ground outside the lining of the intended shaft—the freezing process will occupy from ten to fourteen days.

When it has been ascertained by means of bore-holes that the wall of ice round about the intended shaft is thick enough, the operation of sinking is commenced. The ice is cut out by hand, and a descending cylinder of masonry or iron is carried down at the same time. The lining prevents the surrounding ice-wall from breaking inwards, and the bottom cannot burst upwards.

Herr Kohler made a personal inspection of this process at the shaft Archibald now being sunk to the lignite beds at Schneidlingen, in Germany. The shaft passes through a bed of running sand four metres thick. Twenty-three bore-holes were employed in two rows near its sides. The freezing process was completed on August 10 last, when the running sand had become a compact mass of such great hardness that no impression could be made on it by the finger-nail, and it was with considerable difficulty that a flake 15 mm. thick could be broken from it.

Sufficient data do not yet exist for estimating the cost of this process as compared with those already known, but we are of opinion that if the operation of freezing can be effected in two or three weeks, or even months, it will compare favourably with them in this respect under almost any circumstances. We believe also that it is capable of application under a variety of circumstances not mentioned in Herr Kohler's article, such as damming back an excessive flow of water in solid ground, driving horizontal drifts or tunnels through mud and sand, and so on. We would therefore recommend the inventor rather to turn his attention in this direction than to think of condensing the intake air of mines by the application of cold, with the view of dispensing with ventilating furnaces and enabling winding operations to be carried on in upcast as well as in downcast shafts. The former field, if we mistake not, will be a large one; the latter, we can safely promise him, will be a very small one.

WILLIAM GALLOWAY

NORDENSKJÖLD'S GREENLAND EXPEDITION

IN a series of letters to Mr. Oscar Dickson, Baron Nordenskjöld has given a detailed report of the leading incidents and results of his recent expedition, though it will still be some time ere we can learn what are the full gains to science. The leading novelty of the expedition was, of course, the journey into the interior of Greenland. We have already given some account of Dr. Nathorst's visit to the Cape York region, and in the present article will confine ourselves mainly to Nordenskjöld's own journey up the interior. We reproduce a sketch map of this journey, which Mr. Dickson has been good enough to send us. After mentioning his attempt to approach the south-east coast of Greenland, Nordenskjöld says:—

The ice much resembled the big rough blocks which are encountered north of Spitzbergen. The surface here carries a cold current which sets the ice on shore. The polar current is however not very voluminous; thus in a depth of a couple of fathoms Herr Hamberg discovered, through careful survey, a decided warm current from the south. The depth of the sea was not great, and the bottom consisted of large blocks which tore the trawling net and prevented dredging.

After landing Dr. Nathorst and his party at Waigatz Sound, Nordenskjöld went back to Egedesminde, which he reached on June 29. He then proceeds:—

The following day I left for Auleitsivik Fjord, from which my expedition was to start. This fjord is about 130 kilometres long, and very narrow in the middle, not unlike a river, which widens at the bottom into a bay, Tessiusarsoak, into which an arm of the inland ice shoots. This remarkable formation, and the great tides which favour this part of Greenland, make the navigation here very difficult. As in most of the Greenland fjords the sea is deep and free from reefs. A remarkable feature, too, is that icebergs coming athwart the narrows in the fjord cause the water in the bay suddenly to rise some ten to twenty feet. The Esquimaux relate that some years ago a boat with men, women, and dogs was drawn under here by the whirl currents. They are, in consequence, afraid of rowing in the narrows.

In 1870 I had paid a visit to this fjord and examined these difficulties, which I believed would have increased rather than otherwise during the last thirteen years, through those changes which so often occur in the position and size of the moving glaciers which shoot down from the inland ice. On inquiry I was told that no European had been in the fjord since 1870. Still my knowledge of

the feasibility of getting at least some 50 kilometres inland from this spot decided me to select it as my *point d'appui*.

On July 1 the *Sophia* anchored in the bay just north of the inland ice. We found here a splendid harbour with clay bottom, some seven fathoms deep, surrounded by gneiss rocks from 600 to 1000 feet in height, the sides of which are in some places covered with low but close shrubs, or clothed with some species of willow, mosses, and lichen, which, when we arrived, were ornamented with a quantity of magnificent blossoms. From one of the slopes a torrent descended, the temperature of which was 12°·3 C. The weather was fine, the sky cloudless, and the air very dry. July 1 to 3 were employed in making preparations for the ice journey, while the naturalists made excursions to various places in order to collect objects relating to the conditions of the country. On the night of the 3rd everything was ready for a start, and after some difficulty in reaching the spot where the baggage was we were fairly off. The spot from which we set out on the journey was only five kilometres from the actual shore, and situated below a little lake into which a number of glacier rivers fell. We proceeded up the river in a Berton boat purchased in England. On the night of the 4th we camped for the first time on the ice. The expedition consisted of nine men besides myself. After a great deal of hard work in getting the sledges over the ice, which was here very rough, we found on the morning of the 5th that it was impossible to proceed eastwards, but were compelled to return to the border of the ice and then continue to the north or north-east until finding smoother ice. This first part of the ice was furrowed by deep crevasses and ravines, causing us much trouble. We covered, however, a good distance that day, and pitched our tent near a land ridge in the ice 240 m. above the sea.[1] On July 6 I sent the Lapp Lars forward to reconnoitre, and he reported that it was still impossible to proceed eastwards, but if we marched for a day or so to the north we would find the country accessible to the east. As I feared, however, the impossibility of dragging the sledges with the weight on them over the rough ice, I selected provisions, &c., for forty-five days and left the rest in a depot in the ice. We now resumed the march. It was very interesting to witness the great ease with which the Lapps proceeded among the ice ravines, how easily they traced a road discovered, and with what precision they selected the least difficult track.

The Lapp Lars carried, instead of an alpenstock, a wooden club, with which he had slain more than 25 brown bears, full of marks from their teeth, and his eyes sparkled at the thought of encountering a white one. On the night of the 6th we held our third camp on the ice, and now several officers and men from the *Sophia*, who had accompanied us thus far, left us. Besides the most advantageous requisites for such a journey, we had with us a cooking apparatus for petroleum, and here I beg to say that I found this kind of oil far more suitable than train or vegetable oils, which I had used on my former expeditions, and I recommend the same most warmly to Arctic explorers. Of scientific instruments I may mention compasses, two chronometers, a circle by Pistor and Martin, a small sextant, in case of the former being damaged, a mercury horizon, three aneroid barometers, thermometers, magnets, for the study of the clay deposit in the snow, a topographical board, a photographic apparatus, blowpipes, flasks, nautical tables, &c. The sledges "kalkar," six in number, were of the same kind as those on which Swedish peasant women bring their wares to market; the harness was made so strong that it would hold a man in case of his falling into a crevasse. In addition to these things we had a manilla rope specially spun for the expedition at the Alpine purveyor's in Paris. The food supplied per day may perhaps interest explorers. It was—breakfast: coffee, bread, butter, and cheese (no meat or bacon); dinner: 42 cubic c.m. Swedish corn brandy (*bränvin*), bread, ham or corned beef, with sardines; supper: preserved meat, Swedish or Australian. Sometimes preserved soup was served with dried vegetables. Five men were tectotalers, but there was no need of supplying them with extra rations. For cooking, 0·7 litres of spirits were consumed per day. Our whole baggage weighed a ton, a weight which might easily have been drawn across a smooth snow or ice field, but which was very difficult of transporting over the rough and cut-up surface we had to traverse. Our daily march, between July 7 and 9, was, therefore, not great, viz. 5 kilometres a day. In addition to the crevasses and ravines, we encountered innumerable rivers, swift, and with steep banks which were difficult of crossing, which was generally accomplished by laying three alpenstocks across them. If I had not selected these of the toughest wood obtainable, we should often have had to make detours of many kilometres.

On these days we found on several occasions large bones of reindeer on the snow, and it was but a natural and pardonable conclusion to arrive at, that they were those of animals who had fallen in their wandering over the "Sahara of the Arctic regions." But that good signs are not always true ones we soon discovered.

During the entire journey we had great difficulty in finding suitable camping places. Thus either the ice was so rough that there was not a square large enough for our tent, or else the surface was so covered with cavities, which I will fully describe later on, that it was necessary to pitch it over some hundred smaller, and a dozen larger, round hollows, one to three feet deep, filled with water, or else to raise it on a snow-drift so loose and impregnated with water that one's feet became wet even in the tent. An exception to this was the place where we camped on July 9, viz. camping-place No. 6. We encountered here a small ice-plain, surrounded by little rivers, and almost free from cavities, some thirty metres square. All the rivers flowed into a small lake near us, the water from which rushed with a loud roar through a short but strong current into an enormous abyss in the ice plateau. The river rushed close to our tent, through a deep hollow, the sides of which were formed of magnificent perpendicular banks of ice. I had the spot photographed, but neither picture nor description can give the faintest idea of the impressive scene, viz. a perfectly hewn aqueduct, as if cut by human hand in the finest marble, without flaw or blemish. Even the Lapps and the sailors stood on the bank lost in admiration.

At first we had followed the plan of bringing the baggage forward in two relays, but, finding this very fatiguing, I decided to bring all with us at once. I found this to answer better. On July 10 we covered thus nine and a half, on the 11th ten, and on the 12th eleven, kilometres. The road was now much better than before, although stiff enough. An exception to this was, however, formed by the part we traversed on the 11th, when we proceeded alongside a big river, the southern bank of which formed a comparatively smooth ice plain, or rather ice road, with valleys, hills, cavities, or crevasses, some five to ten kilometres in width, and five kilometres in length. This plain was in several places beautifully coloured with "red" snow, especially along the banks of the river. It was the only spot on the whole inland ice where we found "red" snow or ice in any quantity. Even yellow-brown ice was seen in some places, but, on the other hand, ice coloured grayish-brown or grayish-green, partly by kryokonite, and partly by organisms, was so common that they generally gave colour to the ice landscape.

[1] The altitudes were ascertained by comparing three aneroid barometers, while observation was simultaneously made at Egedesminde with a splendid sea barometer I had left there for that purpose. As the figures have, however, not yet been verified, they may be slightly altered. They seem on the whole too low.

Even on July 12—between camps Nos. 7 and 8—we found blades of grass, leaves of the dwarf-birch, willows, crackberry, and pyrola, with those of other Greenland flora, on the snow. At first we believed they had been carried hither from the interior, but that this was not the case was demonstrated by the circumstance that none was found east of camp No. 9. The only animals we discovered on the ice were, besides the few birds seen on our return journey, a small worm which lives on the various ice algæ, and thus really belongs to the fauna of the inland ice, and two storm-driven birds from the shore. I had particularly requested each man to be on the look-out for stones on the ice, but after a journey of about half a kilometre from the ice border no stone was found on the surface, not even one as large as a pin's point. But the quantity of clay dust ("kryokonite") deposited on the ice was very great; I believe several hundred tons per square kilometre.

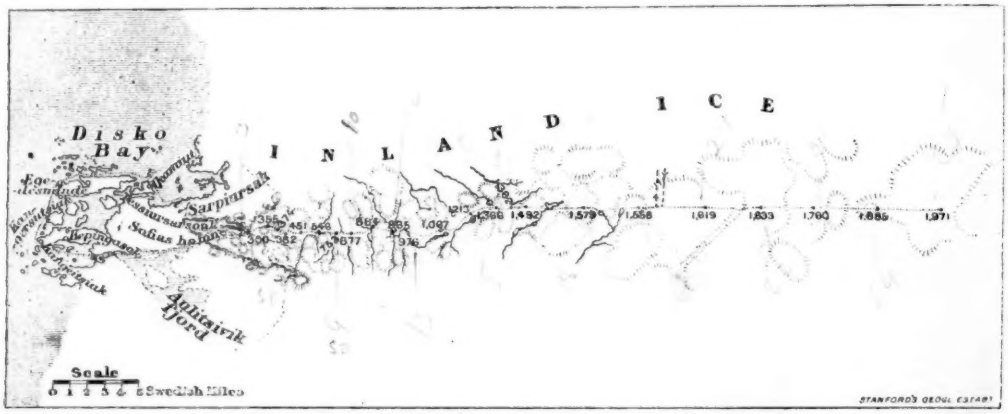
We now ascended very rapidly, as will be seen from the subjoined statement of our camps:—

3rd	camp,	300	metres	above the sea.
4th	,,	355	,,	,,
5th	,,	374	,,	,,
6th	,,	382	,,	,,
7th	,,	451	,,	,,
8th	,,	546	,,	,,
9th	,,	753	,,	,,

The 9th camp lay on the west side of an ice ridge close by a small, shallow lake, the water from which gathered as usual into a big river, which disappeared in an abyss with azure-coloured sides. From this spot we had a fine view of the country to the west, and saw even the sea shining forth between the lofty peaks on the coast; but when we reached east of this ice ridge the country was seen no more, and the horizon was formed of ice only.

Through an optical illusion, dependent on the mirage of the ice horizon, it appeared to us as if were proceeding on the bottom of a shallow, saucer-shaped cavity. It was thus impossible to decide whether we walked up or down hill, and this formed a constant source of discussion between us, which could only be decided by the heaviness of the sledges in the harness. The Lapps, who seemed to consider it their sole business that we should not be lost on the ice, came to me in great anxiety and stated that they had no more landmarks, and would not be responsible for our return. I satisfied them, however, with the assurance that I would find the way back by means of a compass and solar measurements. In spite of this the Lapps easily traced our route and our old camps with an accuracy quite marvellous.

During our outward journey I determined the site of each camp astronomically, and thus the distances which, when the determinations have been calculated, will be given on the map to be drawn of the journey will be absolutely correct. But the distances covered by the Lapps have been made according to their own judgment. The kilometres we covered every day, including the numerous detours, were ascertained by two pedometers.



The heights are given provisionally in metres. Swedish mile = 6·64 English miles.

Up to the 9th camp we were favoured by the finest weather, generally with a slight south-east wind, cloudless sky, and a temperature in the shade, three feet above the ice, of 2° to 8° C., and in the sun of even 20° C. The centre of the sun's disk sank in this spot for the first time below the horizon on July 15, and the upper rim, if allowance is made for refraction, on July 21. After the middle of July, when at an elevation of 4000 to 7000 feet, the nights became very cold, the thermometer sinking to 15° and 18° below freezing-point of Celsius.

The constant sunshine by day and night, reflected from every object around, soon began to affect our eyes, more so, perhaps, because we had neglected to adopt snow-spectacles at the outset of our journey, and snow-blindness became manifest, with its attendant cutting pains. Fortunately Dr. Berlin soon arrested this malady, which has brought so many journeys in the Arctic regions to a close, by distributing snow-spectacles and by inoculating a solution of zinc vitriol in the blood-stained eyes. Another malady—if not so dangerous, at all events quite as painful—was caused by the sunshine in the dry, transparent, and thin air on the skin of the face. It produced a vivid redness and a perspiration with large burning blisters, which, shrivelling up, caused the skin of the nose, ears, and cheeks to fall off in large patches. This was repeated several times, and the pain increased by the effect of the cold morning air on the newly-formed skin. Any similar effect the sun has not in the tropics. With the exception of these complaints none of us suffered any illness.

On July 13 we covered thirteen, on the 14th ten, and the 15th fourteen, kilometres (9th to 12th camps). At first the road gradually rose, and we then came to a plain which I in error believed was the crest of the inland ice. The aneroids, however, showed that we were still ascending: thus the 9th camp lies 753, the 10th 877, the 11th 884, and the 12th 965 metres above the sea. Our road was still crossed by swift and strong rivers, but the ice became more smooth, while the kryokonite cavities became more and more troublesome. This was made more unpleasant by rain which began to fall on the afternoon of July 13, with a heavy wind from south-east. It continued all the night, and the next morning turned into a snowstorm. We all got very wet, but consoled

ourselves with the thought that the storm coming from south-east argued well for an ice-free interior. When it cleared a little we strained our eyes to trace any mountains which would break the ice horizon around us, which everywhere was as level as that of the sea. The desire soon "to be *there*" was as fervent as that of the searchers of the Eldorado of yore, and the sailors and the Lapps had no shadow of doubt as to the existence of an ice-free interior. And at noon, before reaching camp No. 12, everybody fancied he could distinguish mountains far away to the east. They appeared to remain perfectly stationary as the clouds drifted past them, a sure sign, we thought, of its not being a mass of clouds. They were scanned with telescopes, drawn, discussed, and at last saluted with a ringing cheer. But we soon came to the conclusion that they were unfortunately no mountains, but merely the dark reflection of some lakes further to the east in the ice desert.

A. E. NORDENSKJÖLD

(*To be continued.*)

THE RE-ENTOMBMENT OF WILLIAM HARVEY

FOR two hundred and twenty-six years the mortal remains of the immortal discoverer of the circulation of the blood rested, unburied, in a vault of a little church in the parish of Hempstead, about seven miles from Saffron Walden, in Essex.

Harvey died on the 3rd of June, in the year 1657, being then in his eightieth year, but the precise place of his death is not known. He fell, full of days and honours, and retained his faculties so completely to the last day of his life that he directed his apothecary, Samboke, what to do in the way of treatment. He beckoned to Samboke to take blood from under the tongue as the speech was failing,—a line of treatment which would have little favour in these days,—and as the sun of June 3 went down he went down also. His death, no doubt, took place in London, and probably near to Smithfield.

On June 26, twenty-three days after the death, the body of William Harvey was laid in the vault at Hempstead. In the interval a cast had been taken from the face for a rough and ready sculptor to work from, and the body, after a custom of the time, rolled first, in all probability, in a cere cloth, had been inclosed in a leaden chest. It was then conveyed to Hempstead, a distance of about fifty miles, in those days a journey of no slight importance. The body was followed by many of the Fellows of the College of Physicians out of town, and it may be that some of them went as far as Hempstead. Certainly one scholar, though he was not a Fellow, namely Aubrey, the historian, was present when the body was put into the vault. "I was at his funeral, and helpt to carry him into the vault." These are Aubrey's words. The vault referred to had been built by Eliab, the merchant brother of the anatomist, and over it was erected a chapel connected with the church at the north-eastern corner. The vault was afterwards filled with the bodies of members of the Harvey family, some few "lapt in lead," like their great relative, others laid in coffins.

For nearly two centuries little seems to have been recalled of the remains of the anatomist. They lay with their kindred in the village sepulchre without reference being made to them. In 1847 Dr. Richardson, F.R.S., then assisting Mr. Thomas Browne, a surgeon in Saffron Walden, was told one day by a cottager that the great Dr. Harvey was buried in Hempstead Church, and next day discovered that it was really Harvey the anatomist and physiologist, and that the body, "lapt in lead" as Aubrey described, lay there probably as it had originally been placed.

At that time the foot of the leaden chest lay under the open window of the vault. There was then no opening in the lead, but the upper surface towards the middle of the body was beginning to show signs of sinking in. There was much dust and several stones on the chest, which were removed. The remains were reported upon after this by Dr. Tyler Smith, who had visited the place, to the Royal College of Physicians, and in 1859 the College deputed the late Dr. Alexander Stewart and Dr. Quain to visit and report. They made their report, and some changes were carried out in the vault; but the window, although protected by the addition of iron bars, was left open, and, under the influence of air and damp, the lead began to give way.

From time to time Dr. Richardson visited the place and reported on the changes which were in progress. In the lower part of the lid of the leaden chest the sinking became so increased that a kind of oblong basin was formed, in which rain water, beating in from the window, accumulated. Then an opening, taking the shape and size of one of the sound openings in a violoncello, was formed, and water was admitted into the shell itself. Twice it seemed filled with thick pitchy-looking fluid, and although the opening was temporarily filled up with solder, the repair did not last very long.

In 1878 Dr. Richardson made another visit to Hempstead, and on November 30 of that year published in the *Lancet* a full report on the condition of the remains, together with six illustrations. The report created considerable attention, and led the way to the alteration that has been recently effected. In January, 1881, the beautiful tower of the old church at Hempstead suddenly fell, dragging a portion of the church with it. It was found that the Harvey vault and chapel were not injured, but that the leaden shell in which Harvey was laid was again filled with water, and that the preservation of the case could not be much longer insured. In February, 1882, the Royal College of Physicians, formed a committee to undertake the duty of placing the remains in a position in which they would be permanently retained. The result was that the College obtained permission of the representatives of the Harvey family to remove the remains from the vault and to place them in a solid marble sarcophagus in the Harvey chapel above. Such is a succinct history of the proceedings previous to the removal and re-entombment on October 18 of this year.

The ceremony of the 18th was extremely simple. As was befitting, a number of the Fellows of the College—eight in all—bore the remains from the vault along the northern side of the church to the western entrance, and so through the aisle to the entrance of the Harvey chapel, on the left of the chancel. The vicar of Hempstead, the Rev. R. H. Eustace, and the curate, the Rev. J. Escreet, led the procession; then came the bearers with their charge on a bier; after them, four of the representatives of the Harvey family; and, next in order, the President, all the office-bearers, and the Fellows of the Royal College of Physicians who had come to take part in the ceremonial.

After a short service the leaden case was placed in the sarcophagus. On the breastplate of the case the original inscription—

Doctor
William . Harvey
Decesed. The . 3.
Of Jvne 1657.
Aged 79 years

was still quite perfect, as was also a rough metal cast of a face with a small imperial from the lower lip to the chin. After the remains had been laid in the marble, the President of the College, Sir William Jenner, placed on them a leaden case containing the College edition of the complete works of Harvey. The volume was the Latin edition of 1766, edited for the College by Mark Akenside, including in the first pages a life

of the illustrious anatomist and discoverer. Together with this volume there was also put into the sarcophagus a memorial bottle cased in lead and containing various details relating to the removal. The bottle included views of the church, before and after the fall of the tower, executed on wood; a description of the church and the vault, and the time the remains had been in the vault; several photographic views of the church; a beautiful photograph of the bust of Harvey; a scroll of vellum on which was engraved a description of the reasons why the remains had been put into the marble, with the names of all who had taken part in the ceremony; and a printed account of the proceedings that were carried out at the second interment on October 18th, 1883. The sarcophagus was then finally closed by rolling on and cementing down the massive cover or lid. On the western side of the sarcophagus is engraved the following:—

THE REMAINS OF WILLIAM HARVEY,
DISCOVERER OF THE CIRCULATION OF THE BLOOD,
WERE REVERENTIALLY PLACED IN THIS SARCOPHAGUS
BY THE ROYAL COLLEGE OF PHYSICIANS OF LONDON
IN THE YEAR 1883.

At the foot are inscribed the words,

WILLIAM HARVEY.
BORN 1578. DIED 1657.

NOTES

WE are glad to learn that M. Dumas is much better, though it is probable he will have to spend the winter in the south of France.

THE arrangements for beginning work at Ben Nevis Observatory will be completed this week, and Mr. Omond will take up his post on the summit in the middle of next week, when observations will be at once begun. The telegraph cable has now been completely laid.

THE Fisheries Exhibition was closed yesterday with much ceremony; its success as a popular exhibition is almost unprecedented, and, as we have pointed out in several articles, some of the exhibits have been of real scientific value.

WE regret to announce the death, last Saturday, of M. Breguet, the well known electrician, member of the French Institute and of the Bureau des Longitudes. M. Breguet's second son, a promising electrician, died about twelve months ago, and was deeply regretted. The death of M. Breguet has been all the more noticed that a few days ago the death of M. Niaudet-Breguet, his nephew, was announced. M. Niaudet-Breguet was also devoted to electricity. The well-known Breguet firm will not be extinguished by these multifarious losses, having been made lately a joint stock company. It is one of the oldest in Paris, having been established in 1783.

THE arrangements for the International Forestry Exhibition which is to be held in Edinburgh next year have been settled. The classification of the exhibits ranges over a wide and interesting field. Practical forestry will be illustrated by implements, models of huts, appliances for floating and transporting timber, and wood-working machinery of every description. The department of forest produce will include a collection of the chief uses to which the raw and the manufactured material of the woods may be applied. The class of scientific forestry will deal with the botany of the forests, forest entomology, preservative processes applied to timber, fossil plants, parasites, and numerous other subjects. Growing specimens of rare and ornamental trees and shrubs, rustic work in arbours, bridges, gates, and seats, and dried specimens of ornamental objects will exemplify the division of ornamental forestry. The remaining departments will include pictorial illustrations of the trees, foliage, and scenery of all countries, and the effects of blight, accident, parasitic growth, and abnormal conditions, together with the literature of forestry, working plans of plantations, and examples of the economic condition of foresters and woodmen. The entries for the Exhibition will close on October 4, 1884.

LAST Thursday, October 28, the three classes of the French Institute held their annual meeting. The addresses were delivered this year by the members of other classes than the Academy of Sciences. In the evening the members of the Institute held a great banquet by subscription among themselves. This is the first time that the annual meeting has been so solemnised.

THE seventh International Geodetic Conference terminated its labours on October 24, when the acting president, Col. Ferrero, proclaimed the result of the new election of the permanent committee, as follows:—Lieut.-General Ibanez, Director-General of the Geographical and Statistical Institute, Madrid, President; Col. Ferrero, President of the Italian Geodetic Commission, Vice-President; and Dr. Hirsch, Director of the Observatory at Neuchâtel, and Dr. von Oppolzer, Professor of Astronomy at the University of Vienna, Secretaries. Prof. Bauernfeind read his report on refraction, which was followed by a proposal, made by Major Hartl, and approved, to the effect that the Conference expressed a hope that all the European States represented in the Association would institute thorough investigations into terrestrial refraction, in order to ascertain the influences which the different characteristics of the ground and of the climate exercise upon refraction. Prof. Schiaparelli, Director of the Observatory at Milan, read the report of the special committee named to consider the proposal made by Prof. Fergola regarding systematic observations of latitude, with the intent of verifying the stability of the terrestrial axis of rotation, and ascertaining the movements of the poles; which report, after some discussion regarding the manner in which the observations should be carried out, was approved.

BARON NORDENSKJÖLD has, in consequence of the attacks which have been made in foreign journals in connection with the unfortunate *Dijmphna* expedition, on his theory as to the navigability of the Kara Sea, telegraphed to Lieut. Hovgaard inquiring whether he considered it would have been possible to reach the Yenisei this summer. Lieut. Hovgaard replied that he was fully convinced that had he been prepared to proceed he could easily have reached Siberia this autumn, and further points out that he could have done so last year also had he not, by signals of distress from the *Varna*, been compelled to leave the lead along the shore of the Waigatz Island, which was open as far as the eye could reach, and enter the pack ice where he was frozen in.

IN No. 3, vol. vi. of the *Deutsche Geographische Blätter* is an article by Prof. Börgen, in which he discusses the objects proposed and the theories entertained by Nordenskjöld in connection with his expedition to Greenland. The paper was written before the expedition left. Dr. Börgen adduces some particulars which make him incline to the supposition that the watershed of Greenland lies rather towards the east than the west. In any case, in consideration of the comparatively short distance of any part of Greenland from the sea, and of its low average temperature, Dr. Börgen argues that winds both from the east and the west must deposit snow everywhere on the weather side of the mountains against which they strike, and so maintain the conditions for the formation of glaciers. These glaciers, again, must in the course of time drift down into the valleys and the lowest levels, the temperature of Greenland even down to the level of the sea

being everywhere below the freezing-point. This view is further supported by ascertained facts and by conclusions drawn from the direction of the winds, as given in Coffin's work, "The Winds of the Globe." The article in other respects communicates important details and arguments regarding the geography of Greenland.

THE Association Internationale Africaine has been so satisfied with the services of the Swedish officers who assist Mr. Stanley in his exploits on the Congo, that four more, who have volunteered their services, have been engaged, and will leave Europe on November 15. We announced some time back that the Royal Geographical Society of Sweden had conferred the *Vega* medal, the greatest honour at the disposal of the Society, on Mr. Stanley. At the last meeting of the Society the President, Dr. Montelius, read a letter received from the explorer, dated Stanley Pool, in which he thanked the Society for the great honour conferred on him.

THE last number of the *Izvestia* of the East Siberian Geographical Society contains a valuable paper by MM. Agapitoff and Khalganoff, on the Shamanism of the Balagansk Buriats of the province of Irkutsk; several letters from the Lena Meteorological Station (already noticed in NATURE), with a plan of the station; meteorological observations made at Markha in August and September, 1882, and at Magan (ten miles to the north-west of Yakutsk), from July, 1882, to March, 1883; and a paper on the settlements of the 14,000 Chinese, Mantchous, and Dahours, who have remained under Chinese rule, although settled on the left bank of the Amur, at and below its confluence with the Zeya. We notice in this paper that during the three great summer inundations of 1881, the level of water in the Amur, one mile wide at this place, and the Zeya 1·3 mile wide, rose as much as 19 feet in a few days, and that the whole change of level of the Amur was, during the summer, as much as 28 feet. This figure, although much below those which are found for the Amur below its confluence with the Sungari, and exceeded during the inundations of 1872, gives some idea of the mass of water poured on the Pacific slope of the great Siberian plateau during the season of the summer rains.

AN interesting relic of the past has just been unearthed in the parish of Pulborough, Sussex, in the shape of a canoe, which was partly embedded under the River Arun, and partly in land on the south side of that river. The boat is of solid oak, and hewn from a single massive trunk. That it was made before the knowledge of metal is evident, as there is not a trace of building or planking. It must have been hollowed by means of the stone axe and of fire. Further evidence in favour of the antiquity of this boat appears to be afforded by the various accumulations which had formed over that portion of it which was embedded in the earth. These strata, to the depth of nine feet, have been ascertained to be loam, yellow clay, a thin layer of leaves, followed by a stratum of blue mud, beneath which lay the boat embedded in drift sand. The prow portion of the boat lay in the river, and this is by far the most dilapidated. The stern is comparatively intact. The present dimensions of the boat are fifteen feet by four feet; but originally it was probably eighteen feet long.

ON Monday, September 24, about 9 p.m., a remarkable phenomenon occurred at Käringön, in the province of Bohus, Sweden. During a perfect calm a violent whirlwind suddenly arose from the south-east, carrying with it a quantity of sand, earth, and straw, when suddenly a bright light lit up every object and made the night as clear as day. This was caused by a magnificent meteor, egg-shaped in form, which appeared in the zenith, and which at first seemed to consist of myriads of large sparks, gradually changing into a star shining with a blinding lustre, and which burst, with all the colours of the rainbow, in the north-west, four to five metres above the horizon. When the meteor had disappeared the wind suddenly fell, and it was again perfectly calm. The phenomenon lasted about sixty seconds. The wind had throughout the day been south and very slight.

DR. MEYER asks us to state that in our note on his paper on jadeite the name *Montevidio* should be *Monteviso*, and he thinks it better, to avoid misunderstanding, to use *jadeite* instead of *jade*. Moreover, the material from Monteviso is only doubtfully jadeite. At Suckow, Uckermark, only one piece was found, but this is the fourth "in North Germany." "At the same time," Dr. Meyer writes, "I take the liberty of drawing the attention of your readers to Prof. Arzruni's recently-published paper on the jade question in the Berlin *Zeitschrift für Ethnologie*, pp. 163-190. The mineralogist of Breslau comes to the same conclusion as myself, *i.e.* that the raw materials were *not* imported from Asia; and the chief reason upon which he relies is that he found the nephrite and jadeite varieties from the different localities to possess *typical* microscopical differences. This alone would suffice to put aside the importation hypothesis. I discovered last September in Graz, Styria, a boulder of nephrite from the alluvium of the river Mur, and shall soon send you a separate copy of the paper which I am about to publish on the same."

A PALÆOLITHIC implement of large size was found a week or two ago by Mr. G. F. Lawrence, of 49, Beech Street, in gravel excavated in the Clerkenwell Road, near the Sessions House. The implement weighs 1 lb. 3 oz., and is slightly larger than the historical implement found near Gray's Inn Lane at the close of the seventeenth century, and now in the British Museum.

A SHARP shock of earthquake was felt at Bermuda on October 20, but no damage was done. A shock was felt at Tashkend at twenty minutes past two on the morning of the 27th, accompanied by loud subterranean rumblings. A despatch from Smyrna dated October 28 reports that the wall surrounding the town, the Aqueduct, and the Hadji Hussein Mosque have been damaged by an earthquake. The minaret and dome of the Hadji Ali Mosque at Capan Vourla have also been injured. At the last-named town one hundred and sixty-nine persons have been seriously, and sixty-one slightly, hurt. Seventy-nine wounded people are in the hospitals.

A ROMAN city has been discovered in Tunis by Lieut. Massenat, who lately accomplished a scientific mission in the vicinity of Bograra (Gulf of Gabes). This city is said to be located in the southern part of Djerba. The circuit of the ruins is about three kilometres.

AN extraordinary case of subsidence has been observed in the vicinity of Bone. The Naiba, an isolated mountain of 800 metres altitude, is gradually descending into the bosom of the earth. A deep excavation has been made all round, encircling the whole ingulfed mass.

WITH reference to our notice of "The Fishes of Great Britain and Ireland," last week (p. 611), Mr. Day wishes us to state that the work will be in two volumes, and that the parts published reach to p. 176 of the second volume.

THE additions to the Zoological Society's Gardens during the past week include a Striped Hyæna (*Hyæna striata*) from Morocco, presented by Mr. Ernest H. Marquis; a Common Squirrel (*Sciurus vulgaris*), British, presented by Mrs. M. J. Mitchison; a Black Rat (*Mus rattus*), British, presented by Mr. Camp; a Laughing Kingfisher (*Dacelo gigantea*) from Australia, presented by Mr. S. J. W. Colman; a Kestrel (*Tinnunculus alau-*

darius), British, presented by Mr. T. E. Gunn; two Pintails (*Dafila acuta*), two Wigeons (*Mareca penelope*), European, presented by Mr. Charles E. Boultbee; a Margined Tortoise (*Testudo marginata*) from the Ionian Isles, presented by Miss Mansell; a Purple-faced Monkey (*Semnopithecus leucoprymnus* ♀) from Ceylon, a Pinche Monkey (*Midas œdipus*) from Brazil, two Common Marmosets (*Hapale jacchus*) from South-East Brazil, deposited; a Chimpanzee (*Anthropopithecus troglodytes* ♂), a Chimpanzee (*Anthropopithecus calvus*? ♀) from West Africa, a Chipping Squirrel (*Tamias striata*) from North America, two Bramblings (*Fringilla montifringilla*), European, purchased; two Simon's Dwarf Jerboas (*Dipodillus simoni*) from Arabia, received in exchange; six Long-nosed Vipers (*Vipera ammodytes*), born in the Gardens.

BIOLOGICAL NOTES

Observations on the Embryology of the Teleosts, by J. S. Kingsley and H. W. Conn. The observations were made during the summers of 1881 and 1882 at the Summer Laboratory of the Boston Society of Natural History at Annisquam, Mass., on the egg development of *Ctenolabrus cæruleus*. The eggs were obtained by surface skimming, and were usually equally abundant during the day and in the evening, and as a rule were more so on the flow than on the ebb of the tide. Half an hour's skimming would produce on an average 150 eggs. These eggs all floated at or near the surface of the water, and presented a marked contrast to those of either an Elasmobranch, Batrachian, Reptile, or Bird, in that the germinative portion is invariably downward or on the lower surface of the egg, while the deutoplasm is uppermost. The stages observed were: the maturation of the ovum, the phenomena of segmentation until the formation of the germ layers, the formation of the three primary layers, the segmentation cavity, the invagination of the hypoblast, and the appearance of nuclei in the intermediary layer of Van Bambeke, the formation of the notochord and neural cords, the former arising from the hypoblast at first as a longitudinal median thickening of that layer, and subsequently becoming segmented off and taking its place among the mesoblastic tissues, the development of the optic bulbs and protovertebræ.

Embryological Monographs.—Under this title Prof. Alexander Agassiz proposes to issue a series of selections from embryological monographs, so as to give the student in an easily accessible form a more or less complete iconography of the embryology of each important group of the animal kingdom. It is not intended that these monographs should be handbooks to the subject, but rather act as atlases to accompany any general work on the subject. The plates will be issued in parts, each part covering a somewhat limited field, and occasional appendices may be published to prevent the plates from becoming antiquated. The illustrations will be accompanied by carefully prepared explanations, and by a bibliography of the subject in octavo. This work, planned out in 1873, has only now been matured. The first part is on the embryology of Crustacea, with fourteen plates, edited by Walter Faxon. The figures on these plates are taken from all the most reliable sources, and an important volume of bibliography accompanies the atlas. The parts devoted to Echinoderms, Acalephs, and Polyps are well advanced, and it is intended to figure the phenomena connected with fecundation and maturation and the history of the formation of the embryonic layers in a separate part, without regard to the systematic zoological connection of the observations.

Ceratodus forsteri.—Mr. Morton got twelve specimens of this fish in the Mary River, Queensland, one only in a net; all the others were trapped by the blacks by being forced through a narrow passage in the river formed by a kind of brushwood. He noticed a curious circumstance as regards their habits. At the time of his visit a number of Eucalyptus trees were in full flower by the banks of the river, and as the blossoms dropped into the water they were eagerly seized and swallowed by these fish. The stomachs of each of the specimens captured were literally crammed with these flowers. An old resident told Mr. Morton that during June to August these fish go in pairs, that they make slight indentations in the muddy bottom in from six to ten feet of water, in which the spawn is deposited, that the male and female fish remain near the spawn, and are not then easily disturbed, that they frequent the same place every year, and that the spawn is frog-like. He had taken it and hatched it in a tub of water, keeping the young alive for some weeks. (W. Macleay in *Proc. Lin. Soc. New South Wales*, vol. viii. part 2, July 17, 1883).

Glycogen was lately found by M. Errera in fungi of the order Ascomycetes (before, it had only been observed in the animal kingdom and in Myxomycetes, organisms which naturalists have placed, sometimes among animals, sometimes among plants). Continuing his researches, he now finds the substance (*Bull. Belg. Acad.*, No. 11, 1882), not only in Ascomycetes, but in many Mucorineæ, such as *Phycomyces nitens*, *Mucor mucedo*, and *stolonifer*, *Pilobolus crystallinus*, *Chætocladium Jonsii*, *Piptocephalis Freseniana*, *Syncephalis nodosa*. He has specially studied *Phycomyces nitens*, the large size of which is an advantage. In it the glycogen does not occur in localised masses, as in the *Asci* of Ascomycetes. When the mycelium filaments are young it is distributed throughout the protoplasm; later it is carried to the top of the cell which is destined to give rise to the sporangium. Its quantity does not diminish notably during formation of the sporangium, so it does not seem to have a preponderant *rôle* in growth of the membrane. It is found in the spores, and probably another portion serves for respiratory combustion; the rest may be utilised for growth of membranes of the sporangium-filament and the spores. Having got 40 grammes of dried *Phycomyces*, M. Errera extracted glycogen with all its reactions, confirming the results of micro-chemical analysis.

MARINE ZOOLOGICAL LABORATORIES[1]

[THE following communication has been forwarded to us by an eminent biologist, with the request that it be reproduced in our pages]:—

Nearly all the European States except England have on their sea-coast marine zoological laboratories; it may therefore, especially in view of the recent proposals of Prof. Lankester, and the manifesto of biologists which has followed it, perhaps be interesting to your readers to peruse the following description of these laboratories; they will then be able to appreciate their utility, indeed absolute necessity, in order to study or pursue investigations in certain branches of science.

These seaside laboratories, or *stations zoologiques maritimes*, have nearly all been founded by zoologists for the purpose of advancing zoological science. Fortunately they also help both students and scientists in other branches of science than that of zoology, the one to arrive at a proficiency of knowledge, the other to carry out interesting and valuable researches which, but for this brotherly help, would be impossible. The countless species of marine animals attract physiologists, histologists, and comparative anatomists to work in a field which may reveal facts hitherto undiscovered in that more limited area which is included in the study of terrestrial and fresh-water animals.

The success of these laboratories is doubtless increased by the fact that they are always in a healthy locality on a bracing seashore, so as to allow a realisation of the apparently anomalous combination of work and rest. The scientist, worn out by fatiguing researches made in town laboratories, finds fresh elements of health and a fresh field for research by passing three or four months at a seaside laboratory.

The first of this class of laboratory is the one founded at Naples by Herr Dohrn, a private enterprise almost exclusively German, which nevertheless has received substantial aid from the city of Naples, and some years hence will become the town property.

In order to work in the Naples laboratory a heavy fee is exacted. Nearly all the tables are retained yearly by different universities or scientific societies; the British Association has two tables. The revenue is greatly increased by the fees of admission to an aquarium of marine animals.

This laboratory is admirably organised; there is an agreement between the authorities and the fishermen that the latter shall take to the laboratory all rare animals that they may chance to find; likewise there is every necessary arrangement for dredging excursions and for diving into the depths of the sea to find such animals as are required for study. There are several sailing boats and a steamboat belonging to the laboratory, which is also

[1] From the *British Medical Journal*, October 13, "Special Correspondence, Paris."

well provided with diving dresses. The animals are kept in a large tank, which is large enough for specimens of considerable dimensions.

France, apart from the laboratory of the Science Faculty at Marseilles, which has an aquarium and a boat, possesses five seaside laboratories. They are distributed as follows: one at Villefranche, superintended by M. Barrois; one at Banyuls, near Port Vendres, superintended by M. Lacaze Duthiers; another at Concarneau, on the south coast of Brittany, superintended by MM. Robin and Pouchet; another at Roscoff, on the north coast of Brittany, superintended by M. Lacaze Duthiers; and one at Havre, superintended by M. Paul Bert. Besides these principal establishments, there are two or three others, such as those of Arcachon and Lucques, which have been founded either by provincial scientific societies, or by professors who have received some slight aid from the corporations of the towns where these laboratories are established; but these laboratories possess neither special tenants, boats, nor sailors, therefore they are only of use to their founders and a limited number of pupils.

The laboratories of Villefranche, Roscoff, Concarneau, Banyuls, and Havre are founded and kept up by the French Government; in some cases the corporations have given money or granted land. The laboratories of Concarneau and Roscoff present two varieties widely different.

The laboratory at Concarneau is situated at the entrance to the port; it was founded by Coste, the well-known embryologist, who wished to study the different conditions attending the reproduction of marine animals. The building consists of two stories: the ground floor is used for the aquariums, three in number; on the first floor are the workrooms. The rocks facing the laboratory have been utilised, and are transformed into eight basins or reservoirs of water, each from 300 to 1200 feet square, and from 15 to 20 feet deep. The aquariums are filled with water by means of a pump set in motion by the wind. There is only one boat belonging to this laboratory, but the French Government always place a war sloop at the disposal of its director; this summer some of the laboratory workers wanted to dredge a long way out at sea, and the Government lent them a despatch-boat. The coast abounds in marine animals, but is poorer in invertebrates than that of Roscoff; it is more especially a coast for sardine fishing. The surrounding scenery is lovely.

Roscoff perhaps offers greater advantages, though fewer attractions. Cabbage-fields and tracts of land devoted to the cultivation of artichokes, though a proof of the mild and delightful climate of this little seaport, are by no means an acceptable substitute for the beautiful scenery of Concarneau, but the treasures of the sea here, more abundant than on the coast of Concarneau, or indeed on any other part of the whole French coast, are ample consolation to the crowd of workers who annually avail themselves of the facilities for studying and carrying out researches which the Roscoff laboratory, founded by M. Lacaze Duthiers, affords them free of cost.

The coast of Roscoff offers peculiar advantages for a seaside laboratory, or, in French terminology, *station zoologique maritime*. The numerous boulders of granite serve as places of shelter for the neighbouring marine animals. It also presents a vast expanse of sand sea-shore and a large bay of slime, thus all the different kinds of marine animals are within reach.

Notwithstanding these remarkable qualifications which M. Lacaze Duthiers quickly detected, he had considerable difficulty to get a footing for his laboratory. It now consists of a large house bought by Government, to which has been recently added the village schoolhouse (*École Communale*), abandoned, since education has become compulsory, for another affording increased accommodation. A third house, opposite to the one bought by Government, is hired for the convenience of the laboratory workers. It must be remembered that Roscoff is only a little fishing village, and it is often difficult to find a room during the summer season, therefore M. Lacaze Duthiers offers a bedroom to all who work in his laboratory.

There are two sailors belonging to the laboratory; and one of the attendants from the Sorbonne laboratory is on duty at Roscoff during the summer months. The garden of the laboratory reaches down to the sea. A large reservoir, measuring 4200 feet, has been constructed, where are kept marine animals, either at liberty or in cases. On a small island opposite the laboratory there is a "bed" where animals of sedentary habits are kept almost at liberty.

The laboratory has three sailing boats adapted for taking excursions among the rocks and on the neighbouring shores, also for dredging either with the usual drag, oyster-drag, or with a coral-fishing apparatus. The fishermen also take a considerable quantity of marine animals to the laboratory.

This Roscoff *station zoologique maritime*, which M. Lacaze Duthiers had so much trouble to found, is now in its fifteenth year. The French Government by degrees added to its local habitation, which, if even at the present time not perfect, is nevertheless of immeasurable utility to scientific workers, and therefore contributes to the progress of science.

The Roscoff laboratory is perhaps more frequented than any other, and is an enduring testimony to the patience and laudable determination of its founder and director. The expenses are defrayed from the fund annually voted by the French Parliament for public instruction. Here, as in all establishments in France for higher education, no fees are paid; but this success was hardly won; the necessary sum was with difficulty wrung from the Government, and the local authorities, notwithstanding the evident advantages such an establishment brings to the village, were equally tardy to grant the concessions eventually obtained, unlike those of Banyuls, who conceded a building site, also a yearly revenue, and subsequently presented the laboratory with a boat.

The most recently organised seaside laboratory is at Havre; the building it occupies was formerly a public aquarium, which the corporation handed over to M. Paul Bert. It is supported from Government and corporation funds, and is more especially destined to facilitate physiological research. Doubtless, when the arrangements now in course of completion are perfected, they will offer all the requirements for studying this branch of science, a qualification evidently all but absent in laboratories founded by zoologists.

It must be admitted that all these seaside laboratories, or *stations zoologiques maritimes*, taken both separately and in the aggregate, render important service to biologists of all nations. Every year there is a large percentage of foreigners among the workers, the English element bearing always the largest proportion, a proof that our countrymen fail to appreciate their good fortune in possessing a more extensive sea-coast than that of any other country, or they would be able to offer this useful form of hospitality as well as seek it. Nevertheless, considering the scanty encouragement given by the public and the English Government to biological science, it is to be feared that many years will pass by before *stations zoologiques maritimes* exist on the English coast.

The only similar laboratory in Holland belongs to the Universities of Utrecht and Leyden. The Dutch coast is not rich enough in marine animals to suggest the advisability of establishing many zoological laboratories, therefore a movable or migratory laboratory has been organised, which consists of a wooden house, easily taken down and put up again; there are three rooms in it, a large workroom, and two smaller ones used for the aquarium and fishing apparatus. At the beginning of every summer it is set up on the coast on a piece of land hired for the purpose, or more frequently lent by the nearest village; thus the Dutch scientists visit the entire coast, study its marine animals, and even that of their neighbours. Russia has a laboratory on the Black Sea, and Austria possesses one at Trieste.

In connection with the above communication, we may state that Mr. Romanes writes to Tuesday's *Times* forcibly pointing out the need of a thoroughly equipped zoological station on the British coast, and its value both to science and to our fisheries. Referring to the recent manifesto, so influentially signed, printed in our columns, Mr. Romanes hopes the executive committee will see their way to adopting its suggestions.

THE ASSOCIATION OF GERMAN NATURALISTS AND PHYSICIANS

THE fifty-sixth annual meeting of this flourishing association was held this year in the city of Freiburg, Baden, under the presidency of Dr. A. Claus. The proceedings opened with an informal gathering in the Concert Hall on Monday, September 17, and concluded on the following Saturday with an excursion to the romantic watering-place of Badenweiler. During the four intervening days the several Mathematical, Physical, Biological, and Medical Sections met regularly in the old University,

the High School, Gymnasium, Chemical Laboratory, and other local institutes. All were fairly well attended, and amongst the distinguished savants present mention may be made of Professors Stickelberger, Fischer, Hildebrand, Weismann, Maier, Drs. Haek, Nicolai, Lehmann, and Thiry. As many as 120 papers and monographs in nearly all branches of science were either read or submitted to the Association, and summaries of most of them inserted in the official journal (*Tageblatt*) of the proceedings. Of this journal four numbers altogether were issued, and their varied contents convey a tolerably accurate idea of the immense amount of work got through during the four days devoted to the special objects of the Association.

In his inaugural address the President dwelt mainly on the vast changes that had taken place in the social and political relations of Germany, and on the great progress made in all departments of human knowledge since 1838, the last year that the Association had met in the city of Freiburg. The five sections, which at that time were found sufficient for its purposes, had developed into twenty-four distinct divisions corresponding to the present conditions of science, and many of these already formed special branches of themselves, with their own independent gatherings and separate organisations. With the progress of discovery in the natural sciences this tendency to constant subdivision of labour became inevitable, and the great encyclopædic minds of former times would henceforth be replaced by specialists compelled to devote all their energies to the cultivation of one or two minor sections of particular physical or biological categories.

A discussion followed on the selection of next year's place of meeting, which was ultimately decided in favour of Magdeburg.

In the Chemical Section, Dr. Frank of Charlottenburg read a paper on siliceous sinter and on its application to chemical and medical purposes. This substance, composed of the remains of microscopical organisms, and entering into the composition of extremely porous siliceous masses, combines the properties of asbestos with those of lightness in the highest degree. It is thus capable of absorbing moisture to the extent of 94 per cent. of its own volume, and may be used without any risk as a disinfectant and for draining damp places.

In the Zoological Department, Dr. Gräff of Aschaffenburg described the results of his investigations of some new species of Myzostoma, completely confirming his former views regarding the relationship of the Myzostomidæ to the Tardigrade family. He explained the reproductive processes of the Myzostomæ, and the form of their cysts, and reported the discovery of these cysts on fossil crinoids. He also gave an account of the germs of *Volvox viridis* in filtered water exceptionally developed from colourless individuals. Dr. Döderlein described some fossil sponges from Japan of highly intricate structure, but all developed originally from simple Radiate types. They were related to Tetractinellidæ, and more particularly with Pachastrella.

The journal for Friday, September 21, is largely occupied with an extremely interesting monograph by Prof. Hertwig of Jena on "Symbiosis in the Animal Kingdom." This term symbiosis, first suggested by De Barry in connection with certain phenomena of the vegetable world, is here extended to the whole organic system. As distinguished from ordinary parasitism, it is explained to mean the normal fellowship or association of dissimilar organisms, which dwell together in a common abode for their mutual welfare. In the case of parasites the connection is altogether one-sided, one of the two organisms attaching itself to the other, and flourishing at its expense, as, for instance, the mistletoe on the apple-tree. But in this newly revealed phenomenon of symbiosis, which appears to pervade the whole biological world, both associates are mutually beneficial, and in some instances even indispensable to each other. They act, so to say, like two partners in a well-regulated business concern, cooperating in the work of life, taking part in all its toils and troubles, and honourably sharing the common profits. An illustration is drawn from the familiar hermit crab, one species of which, after taking possession of the first available empty shell, goes into partnership with a sea-anemone (*Adamsia palliata*). This lovely creature, bright orange spotted with red, attaches itself to the roof of the common abode in such a position that its mouth and prehensile apparatus are always turned towards the head of its associate. It is thus enabled to join in all the expeditions of the restless hermit crab, and conveniently share in the common plunder. In return for this service the anemone protects its companion from his many enemies by means of the numerous long threads which it shoots out at the least alarm, and which are provided with millions of capsules charged with a stinging acid like that of the common nettle. So close is the compact entered into by the two partners, that both have become indispensable to each other, as appears from a series of experiments made at the Neapolitan Aquarium. If the crab be removed from his house, and this be stopped up, so as to prevent his reentering it, he will cast about for another shell, and never stop until his old associate is also transferred to their new abode. A still more remarkable illustration is drawn from the *imbauba*, or candle-nut tree, of South America, which strikes up an alliance with a species of small black ant to their mutual benefit. The whole subject of symbiosis, which naturalists are only beginning to study, is calculated to throw great light on the Darwinian theory of biological evolution. The various cases of fellowship between animals and plants of different orders, and even between members of the animal and vegetable kingdoms show how, in the perpetual struggle for existence, the individual organism avails itself of the smallest advantage to secure a place in the household of nature. It often thus acquires marvellous habits of life, which it is afterwards unable to lay aside, and in consequence of which it becomes gradually modified in its bodily form and organisation. Thus *abyssus abyssum invocat*, one change superinduces another, altered conditions require fresh combinations, and the organic world resolves itself into an everlasting ebb and flow of life, in which the individual counts for nothing, the species—itself transitory—for but little, and the sum of existence alone is considered in the self-adjusting scheme of the universe. Symbiosis thus leads at once to a broader and more searching study of various branches of human knowledge. To prosecute the subject successfully vegetable and animal organisms must be examined, normal and morbid conditions attended to, anatomical and physiological questions investigated. For this boundless theme belongs to a border land, in which zoology, botany, anatomy, physiology, and pathology meet as on common ground.

In the Physical Section the subject of the pyroelectricity of crystals was discussed by Prof. A. Kundt of Strasburg, who explained his recently-published method for the observation and investigation of this phenomenon.

In the Mineralogical Department papers were submitted by Dr. Petzholdt of Freiburg, on the formation of coal; by Dr. Dölter of Graz, on his attempts to produce artificial gems, in which he pointed out that the mineralogical composition does not depend directly on the chemical alone; by Dr. Kloos of Karlsruhe, on the change of labrador to an albite and a zeolitic mineral. Dr. Fischer of Freiburg dealt with the question of the natural presence of nephrite, jade, and chloromelanite in various parts of the Old and New Worlds, and the great importance of these minerals in connection with prehistoric remains and early migrations. Special reference was made to the work recently published by Dr. A. B. Meyer, of Dresden, "On Jade and Nephrite Objects," and in the discussion that ensued none of the members present subscribed to the views advocated in that work.

In a paper "On the Higher Cryptogams" Prof. Michaelis bases an objection to Darwinism as a scientific hypothesis on the grounds first that the accepted theory of the fertilising process, especially in the case of the heterospores, rhizocarps, and dichotoms, rests on pure analogy, without any actual demonstration, and secondly, that in the mosses the sexual origin of the sporogonium from the mother plant shows a fresh formation of a totally distinct organism out of that previously existing. Nature thus yields an unanswerable argument against the Darwinian assumption, inasmuch as here the second individual is dependent, and under no circumstances capable of a separate existence.

Prof. Nüsslin of Karlsruhe described a new protozoon from Lake Herrenwies, Baden, the *Zonomyxa violacea*, holding a middle place between the Pelomyxa and Amphizonella of Greeff.

In the Geographical and Ethnological Sections, which were on the whole rather poorly represented, Dr. Passevant-Basel gave an account of his residence in the Cameroons, West Coast of Africa, during the months of February to June, 1883. A paper was read by the same naturalist on the African races, with special reference to the unity or diversity of the negro type. The author agrees with those anthropologists who subdivide the Negroes into several stock races, basing his conclusions on a comparative study of the hand and skull.

Prof. Doelter, of Graz, discussed the hypothesis of a vanished Atlantis, and the former possible connection of Africa and

America. From a careful study of the geological conformation of the north-west coast of Africa, of the Cape Verde, Canary, and Azore Archipelagos, he considers that a union of the two continents in remote epochs is scarcely conceivable. On the other hand, the former existence of a large island, comprising the Canaries, Azores, and Cape Verde group, may be regarded as not improbable. But whether this island was at any time itself connected with the African mainland is a question which cannot be decided without further investigation of the local conditions.

LOCAL SCIENCE SOCIETIES AND THE MINOR PREHISTORIC REMAINS OF BRITAIN[1]

IN the annual address which I had the pleasure of delivering to the Essex Field Club at the beginning of this year I ventured to put forward a suggestion which I will take the present opportunity of enlarging upon in the presence of this gathering of the representatives of so many of the local societies of this country.

Of the various branches of natural science cultivated by our respective societies perhaps no subject possesses so widespread an interest as the early history of man. It is only in recent times that materials have been gathered with anything like scientific method from the fragmentary records of the past. By the methods of modern research these materials have been coordinated into that imperfect sketch of the physical characters and mode of life of the early inhabitants of this and other countries which constitutes our present knowledge of prehistoric archæology. But vast as have been the strides in this department of knowledge within the last quarter-century, it is certain that even now we are only on the threshold of a dim region into which advance is becoming more and more difficult with the increasing scantiness of the evidence the further we penetrate backwards into the history of our race. The labours of cave-hunters and searchers into our ancient river gravels—the excavators of our earthworks and tumuli have garnered a rich harvest of facts upon which is based the existing knowledge of ancient man. The old method of solving problems in prehistoric archæology by attaching a tradition to any ancient monument of which the history was unknown has been weighed in the balance and found wanting. The erudite verbiage of the old-school antiquarian has been displaced by the shovel and pick of the modern investigator.

While the spirit of scientific inquiry is thus gradually enabling us to reconstruct some few chapters of the past history of man from such remains as have been preserved to us, the extreme importance of the relics themselves is as a natural consequence becoming more and more recognised. It must have been with the greatest satisfaction that anthropologists heard that the ancient monuments of this country, thanks to the foresight of Sir John Lubbock, were to receive Government protection. For years past the destruction of the most venerable relics has been going on, partly through local ignorance of their value, partly through wilfulness, and partly through the unavoidable clearance of ground for building and agricultural purposes. But although the larger and better-known remains are now secured from demolition, there are numerous smaller and less-known relics scattered over the country, which in the course of time are doomed to destruction by the advancing tide of civilisation. As may be seen on reference to good topographical works, the irreparable losses which anthropological science has already incurred in this way are enormous. The most deplorable feature in these cases of destruction is that they have occurred without adequate scientific supervision, and any evidence that might have been gathered by competent watchers has been for ever lost.

The systematic exploration of earthworks, barrows, tumuli, &c., by the method of excavation is necessarily expensive work, and it is to me a matter of some surprise that the munificent example set by men like General Pitt-Rivers and Canon Greenwell has not been more widely followed by those who, with the knowledge of this difficulty, have it within their means to promote this branch of research. As in the case of one of the societies which I have the honour of representing (the Essex Field Club), which at the instigation of General Pitt-Rivers undertook the investigation of the ancient earthworks in Epping Forest, good work can sometimes be done by a local society by raising a fund for the purpose of exploring such remains in its own district, and this leads me to the immediate object of the present paper.

In attempting to draw up any suggestions for the guidance of local societies, the great difficulty appears to be the impossibility of finding any subjects for research of a sufficiently general scope to be open to all societies. The subjects already proposed by the committee appointed last year by the conference of delegates are, as you are aware: (1) underground waters, (2) erratic blocks, (3) underground temperature, (4) rainfall, (5) periodical natural phenomena, (6) injurious insects. To these I am now about to suggest the addition of another subject, viz. (7) prehistoric remains. Here, as it seems to me, there is a useful field for cooperation among the societies of all counties. Thanks to the increasing interest in scientific matters now making itself felt throughout the country, there is perhaps no corner of Britain which does not or could not be made to fall into the province of some local society or field club. In view of the imminent destruction of many of the minor remains on the one hand, and the scheduling of the larger remains for State protection on the other hand, I believe that occupation of the greatest scientific importance exists for all local societies.

The time has perhaps not yet arrived for laying down any rigid system for dealing with the proposed subject, and I therefore think it advisable at present to confine myself to a few general observations respecting the nature of the work which it is desirable that local societies should take in hand. It must be understood that these remarks are limited to prehistoric archæology, as the remains belonging to the historical period are generally dealt with by archæological societies, and do not come within the range of science subjects admitted by the British Association.

Assuming then that all societies have prehistoric remains of some kind within their districts, the first and most essential thing to be done is to draw up catalogues of these relics, giving their position, external form and structure, and bibliographical references. If the societies of each county would undertake this task, arranging matters so that no relic, however apparently insignificant, escaped their vigilance, we should thus in time come to possess a complete catalogue of all the ancient remains of Britain, and at the same time we should gradually get together a most valuable collection of literary references. The bibliography is essential, because so many of our ancient remains have from time to time been investigated and the results buried in some obscure archæological paper, the disinterment of which is in itself a piece of antiquarian research. A catalogue such as the one now proposed would thus serve many useful purposes. We should have an index-guide indicating precisely where prehistoric remains exist at the present time, and further whether they had ever been systematically explored, and if so with what results. At the same time, attention would be directed to many relics which the local society and the Government inspector might deem worthy of being scheduled for State protection. By this means I am disposed to believe that the operation of the Ancient Monuments Bill would be considerably accelerated, and its effectiveness thereby increased.

It will be as yet premature to suggest any general form in which the proposed catalogue should be cast. Each society would no doubt at first work upon a plan of its own. But whatever form be adopted it is advisable that publicity should be given to the results in the Transactions or Proceedings of the respective societies, as the purely local interest in the work would be thus greatly enhanced, and the working up of the whole into one compendious catalogue might possibly be done later by a committee of the British Association composed partly of delegates from local corresponding societies, and partly of other eminent authorities in prehistoric archæology whose assistance and advice it would be most desirable to secure.

If the scheme now broached should be deemed worthy of consideration by your respective societies, it would be essential, in order to carry out the work effectively, to appoint from your councils and members ancient monument committees, whose function it would be to draw up the proposed catalogue, visiting the remains to be entered in all cases where possible, and exhausting the topographical literature in order to avoid including any fictitious remains. Where no literary references are to be found, and in cases where doubtful structures exist, it would be

[1] A paper read at the Conference of Delegates from Local Societies and before the Anthropological Section of the British Association at Southport, by Raphael Meldola, F.R.A.S., &c., Delegate of the Essex Field Club and the Braintree and Bocking Natural History Society. Communicated by the Author.

all the more advisable to enter these in the catalogue, with appropriate remarks, so that systematic explorations might be made when the opportunity presented itself for raising a fund for the purpose. Even when local histories or traditions are decided respecting the age of any earthwork or other ancient structure, but little credence can be attached to such traditions until actual investigations have been made. As far as my own experience goes, and from information derived from other sources, it would appear that local tradition is the bane of the scientific archæologist. There is, for instance, hardly any prehistoric monument in this country that has not been pronounced Roman by some antiquarian authority, an opinion which not only has often been proved by excavation to be erroneous, but which has also had the pernicious effect of checking further inquiry.

In recommending to your societies the actual investigation of the minor prehistoric remains of your districts as a task well worthy of the attention of any scientific body, it is perhaps not wholly necessary to urge that any excavations attempted should be carried out with the most scrupulous care, and the materials removed restored if possible on the completion of the work, so as to avoid any permanent disfigurement. The so-called "exploration" of many ancient structures whose venerable antiquity should have rendered them sacred has often been conducted in a manner which can only be called an act of desecration. How frequently do we read in local histories such statements as the following:—"On —— Common there formerly stood a large mound of earth supposed to be a tumulus, which was opened by Mr. —— in the year ——, but nothing of any interest was found *except a few fragments of pottery and some decayed bones*"! Such passages as this, which is not a verbatim extract but simply an ideal specimen illustrating the kind of destruction that has been going on, lead to the supposition that the prevailing idea in opening a tumulus is the discovery of hidden treasure. Any other find is considered devoid of interest, and the scientific value of the structure is for ever lost by the scattering of its contents.

The ancient monuments committees of local societies, in addition to the preparation of catalogues and the conduction of explorations, would have another important function to fulfil: they might take upon themselves the duties of vigilance committees, keeping a watchful eye upon the ancient remains in their neighbourhood, and preventing as far as possible their destruction. In the case of minor remains which were not considered worth scheduling for State protection, opportunities would often occur for investigating without incurring the expense of systematic excavation. In the course of building or agricultural operations old ramparts are frequently cleared away in perfect ignorance of their value to the archæologist; or again, a new road has to be made, which in its course passes through the remains of some ancient earthwork now almost obliterated by the hand of time. In such cases the vigilance committee, having previously catalogued the remains threatened, would endeavour to come to some arrangement with the owner of the property, and obtain permission to appoint watchers for the purpose of recording the nature and position of any relics that might be found. The fact that local societies have not in past times been sufficiently alive to the important work which might thus have been done by taking advantage of any unavoidable demolition of prehistoric remains has led to the destruction of a vast amount of material which, under proper supervision, might have furnished facts of lasting importance to anthropological science. It remains with your respective societies to determine whether such ruthless waste of evidence is to be allowed in the future.

OBSERVATIONS ON HEREDITY IN CATS WITH AN ABNORMAL NUMBER OF TOES

DURING the last few years I have had occasional opportunities of studying heredity in various families of cats with an abnormal number of toes, and whose ancestors for some few generations at least, have possessed the same peculiarity. The observations have now been continued over a period long enough to render their publication a matter of interest. I first became acquainted with these cats in the winter of 1878, when staying near Haverfordwest. I made inquiries on seeing one of them for the first time, and ascertained that it had been obtained from Mr. Edward Vaughan, of Fern Hill, Haverfordwest, a relation of the friend with whom I was staying. Shortly afterwards I saw Mr. Vaughan, and had a long talk with him about the peculiarity. At the time I took notes of his experience, and he has since kindly written to give further information. He first became acquainted with two generations of tortoiseshell cats with the normal number of toes (living respectively to the ages of eleven and twenty). Then in the third generation the extra toes appeared (this cat died aged nineteen, and was also a tortoiseshell). This cat or the mother was brought from Bristol to Haverfordwest. The peculiarity was inherited by "Punch"—a cat now living, and fifteen years old last May, also a tortoiseshell—making four generations. "Punch" has six toes on each fore foot, and six on each hind foot, but two of her kittens have had seven on hind and fore feet, and all varieties between the extreme and normal form have occurred commonly. It is a very curious and interesting fact that now in her old age all her kittens have the normal number of toes. Mr. Vaughan is of opinion that the peculiarity is also dying out among "Punch's" descendants, but this is by no means my experience with the branch of the family I have observed. He also gained the impression that the female kittens were more affected with the peculiarity than the males. Mr. Vaughan also made the interesting observation that the peculiarity reappeared in the kittens of a normal female cat (a daughter of "Punch's"), although in smaller proportions.

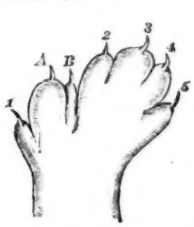


FIG. 1.—Right fore paw from above, with extra toes.

FIG. 2.—Right fore paw from below, with extra toes.

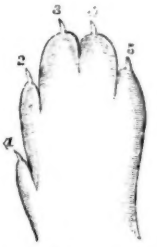


FIG. 3.—Right fore paw from above, normal.

FIG. 4.—Right fore paw from below, normal.

In the spring of 1879 Mr. Vaughan very kindly sent a female tabby kitten to my home at Reading. This was a daughter of "Punch's," and it possessed six toes on each fore foot and six on each hind, thus rendering the feet very broad and giving them a most remarkable appearance. This cat, although rather wild, was very clever, being easily taught to "shake hands," and catching birds and even fish with surprising ease. When a little over a year old the first family (of four) was born, in the middle of June, 1880.

All the four kittens were tabbies, and I made the following notes of them:—(1) male: fore paws, five toes, but the insignificant innermost toe being absent, the foot appeared broad like the mother's; hind paws, five toes. (2) female: fore paws, five toes, same as (1); hind paws, six toes. (3) and (4) females: normal; five toes on fore paws, four on hind. No. (2) in this list was given to a friend, and will be again referred to. One normal female was also given away, but was soon lost without offspring; the other female was killed. There is nothing in the above list to support the view that the females are more affected than the males with the mother's peculiarity.

The next family of which I have notes was born May 13, 1881. The three kittens were tabbies as before:—(1) male: normal. (2) female: normal. (3) female: six toes on each fore and hind foot, as the mother. Here the only affected kitten is a female.

The next and last family of which I have notes was born August 26, 1881. I received notes of three kittens, but there may have been more:—(1) and (2) females: six toes on each fore and hind foot, as the mother. (3) sex not observed: six toes on all feet, as the mother.

After this I was unable to obtain notes, although many families were born, and a large proportion always possessed the peculiarity. Few people are aware of the immense difficulty in obtaining accurate notes of a simple observation such as this.

The mother was subsequently killed.

I now return to No. (2) of the first family, which was given to a friend on the condition that I received accurate notes of all families. I received *one* such account. This was of a family of four born in June, 1881:—(1) male: normal. (2) female: normal. (3) female: with five toes on the fore paws, six on the hind, same as mother. (4) female: the same as mother, but five toes on the hind feet. Here again the females possess the peculiarity. The mother was also a small, very clever cat, catching birds with the most wonderful ease. There were many families, in each of which quite half possessed the peculiarity, and many of the kittens had the same number of toes as the mother.

At last, about a year ago, a female tabby kitten appeared with *seven* toes on each fore paw, and six on each hind. This was given to me, and is now a small tabby cat, with a tendency towards tortoiseshell coloration on the back. A rough drawing of the right fore foot, as seen from above and below, is seen in Figs. 1 and 2. Drawings of a normal right fore foot are given in Figs. 3 and 4, for comparison. It is seen that the extra toes are those labelled A and B, and they confer the extraordinary breadth upon the foot. The most recently added is B, which is still partially coalesced with A, and has but one pad in common with it (Fig. 2). This last toe, B, was absent in the cat which I received from Mr. Vaughan. In the first family described, Nos. (1) and (2) possessed the largely developed extra toe, A, while the insignificant pollex (Fig. 1, 1) was absent, and thus the foot appeared extremely broad, although with only the normal number of toes. In walking the pollex does not touch the ground, but the claws A and B come down a little later than the rest of the foot, making a very distinct click when the cat is walking on floorcloth. This sound is particularly audible when the cat is coming down stairs. Comparing the pads on the underside of the foot with those of a normal animal (Figs. 2 and 4), there is seen to be an extra pad behind the additional toes, of which there is no trace in the normal foot. The left foot is similar to that drawn, except that there are traces of more complete fusion between the toes A and B in the slighter tendency towards division shown by their common pad. The right hind foot from above and below is given in Figs. 5 and 6, and a normal hind foot for comparison in Figs. 7 and 8. The correlation of the toes is more difficult here, but there is little doubt that the innermost toe (Figs. 5 and 6, 1) is the hallux, lost in the normal foot.

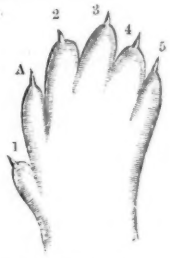


FIG. 5.—Right hind paw from above, with extra toes.

FIG. 6.—Right hind paw from below, with extra toes.

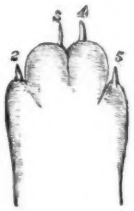


FIG. 7.—Right hind paw from above, normal.

FIG. 8.—Right hind paw from below, normal.

Comparison with the fore feet renders it likely that the second extra toe is that labelled A in Figs. 5 and 6. On the underside (Fig. 6) all the toes have separate pads, and there is an additional pad behind the extra toes. This, in the left hind foot of the same animal is fused with the pad behind the other toes.

On July 10 last the cat I have just described produced a family of four tabby kittens. Strangely enough, they are all males, but they possess the mother's peculiarity to a remarkable extent.

(1) Forepaws: exactly similar to the mother's, but toes A and B are more distinct, in that they have separate pads in both feet. Hind paws: precisely the same as the mother's, even to the fact that the left hind pads are continuous and the right hind pads slightly discontinuous (as in Fig. 6). Thus this kitten exhibits on the whole an intensification of the characters.

(2) Fore paws: the pads of the toes A and B are fused as with the mother. The claw of B is broken off, but its base is seen almost springing from the outer side of the base of claw A. Both feet the same. Thus the character is rather less developed than in the mother. Hind paws: the large hind pads are continuous on both feet. All the six toes are distinct on both feet, as with the mother, but A and 2 on the left foot are united by skin, although considerable freedom of movement is possible. Here again the character is rather less than in the mother.

(3) Fore paws: pads of A and B are distinct on the right side. The claw of B is accidentally broken off. On the left side the pads are also distinct, although the toes A and B are joined by skin. Hind paws: all six toes distinct on both feet; the large hind pads continuous on both. Thus this kitten is beyond the mother in the separation of the pads of A and B on the fore paws. A and B were more distinct on the right side, where also in the mother the pad showed a greater tendency towards division.

(4) Fore paws: the greater tendency towards separation on the right side was very strongly marked here, inasmuch as the toe B is entirely absent on the left side, and the pad of A simple. On the right B is present, and its pad is joined to that of A, but a little more distinct than with the mother. Hind paws: all six toes distinct and large; hind pads continuous in both feet. Thus the character is, on the whole, less than in the mother.

This is the last observation made up to the present time, and it is a very remarkable one, in the entire absence of anything approaching the normal form, and in the fact that two of the kittens go beyond the mother, while the other two are but little behind. When the two sides differ, the difference is invariably as with the mother. At the same time the immense strength of heredity in all these cases is seen when we remember that it is practically certain that the fathers of the families have always been normal. It is quite certain with this last family, for the mother was brought as a kitten from Reading to Oxford, where there is a normal male cat living in the house with her. I have never heard of cats with the abnormal number of toes in either Reading or Oxford apart from these. Mr. Vaughan says exactly the same for his cats in South Wales. Thus we must conclude that the heredity is entirely through the females, and yet the character has gone on increasing in my branch of the stock in spite of the normal element which we should expect to be introduced and to make itself felt at each stage. I have known of the family through eight generations, and three of these have started from entirely new localities (*i.e.* Haverfordwest from Bristol, Reading from Haverfordwest, Oxford from Reading) to which they were sent as kittens. This is, of course, very important, as it has prevented the possibility of interbreeding between the abnormal cats derived from the same stock.

I hope to contribute a paper to a future number upon further observations, and upon the skeletal peculiarities that accompany the abnormality.

EDWARD B. POULTON

ON THE ELECTRICAL RESISTANCE OF THE HUMAN BODY[1]

THE writer, after premising that hitherto electricity in its application to the human body had not come up to expectations reasonable in the case of so powerful a force, and,

[1] Abstract of a paper read before the British Association at Southport, by W. H. Stone, M.A., F.R.C.P.

that it was evidently still in an embryonic state, mentioned some examples of the conflicting and contradictory statements made by different authorities as to its electrical resistance. These varied from 13,000 to 2875 ohms and less. He believed it was enormously overstated, and had for this reason applied himself to make some more accurate determinations. He was at once met by three obstacles:—(1) The difficulty of making good contact through the skin of a living man. (2) The limitation of the amount of current by pain, and by the fact that the rapid opening and closing of strong circuits produced a tetanic state of muscle. (3) The fact that the human body is an easy electrolyte, almost immediately furnishing currents of polarisation.

As regards (1), the axiomatic statement seemed to be that the poles must be infinitely large compared with the current they had to conduct. This condition he had attempted to fulfil in five different ways, two at least of which were successful: either by immersing the feet and hands in baths of brine in contact with an electrode of amalgamated lead or zinc of from fifty to a hundred square inches surface, or by soaking these extremities in brine, and then wrapping a strip of flexible lead two feet long by two inches wide about them, after the fashion of a surgical spiral bandage. The fact that the skin resistance was thus reduced to zero was proved to demonstration by an observation already recorded in NATURE (September 13, p. 463), from which it appeared that the resistance of a corpse, treated with the spiral leaden bandages from foot to foot was 1150 ohms, and with solid silver conductors thrust three inches deep into the plantar muscles was actually 50 ohms more.

Under the heading of contacts it was essential to determine definite anatomical points from which the measurements should start, and which readily admitted of linear verification. Such points existed in the prominence of the ulna at the inner side of the wrist, and the lower edge of the external malleolus at the ankle. The shortest course traversed by the current between these two points had been measured to a quarter of an inch.

There were three principal directions in which determinations had been made:—

1. From hand to hand.
2. From foot to foot.
3. From hand to foot.

No. 1 was much the same as the height of the subject, and was not liable to great variation.

No. 2 varied more, since the difference between very tall and shorter men lies chiefly in the legs.

No. 3 was perhaps the best test of the average conductivity of the body, since looped currents were sure to traverse the whole trunk, and even caused motor disturbance in the extremities not included in the circuit.

Three such observations were given, including one on a man of the exceptional height of nearly 8 feet.

As regards pain, it was noted that the E.M.F. used varied from three to ten bichromate cells of 1·8 volts each. Even the first was occasionally complained of, thus incidentally showing the goodness of the contact obtained. In morbid conditions, such as that termed myxœdema, the E.M.F. of 10 cells or 18 volts through a resistance of only 1260 ohms was easily borne, and indeed hardly felt. The third difficulty, that namely of electrolysis, was the most serious: indeed the particular metal of which the electrodes were made sank into insignificance compared with the rapid and vigorous polarisation of the moist tissues of the body itself. A rotating commutator on Wheatstone's plan, and afterwards a metronomic instrument, by which the periods of alternation could be varied, were first used, but with only partial success. A more delicate mode of discharging was found in the use of an ordinary commutator key worked like a piano with the index and middle fingers of the left hand; a double contact key, putting battery and galvanometer successively in circuit, being beneath the right index finger. The left keys being first depressed alternately, the right key produced a double deflection, while the bridge resistance was too low, which was replaced by an opposite double deflection when it was intentionally made too high. By watching the galvanometer a point was easily found where it ceased to "throw," and then three successive contacts in either direction were taken to determine resistance. In spite of all precautions, the second measurement was sometimes a little in excess of the first, owing to a polarisation-current assisting the battery. This, however, never amounted to more than about five ohms, and was easily allowed for. Between each set of observations a short-circuit key, inserted outside the bridge, was closed for at least a minute, so as to discharge patient, bath, and electrodes.

The measurement was then repeated with inverted current, and the mean taken.

One set of examples out of many was read to the meeting. Three men of very different heights were tested according to the following table:—

	Height.	Weight.	Ulna to malleolus.	Foot to foot.	Foot to hand.
	ft. in.	st. lb.	ft. in.		
1. Mr. Todd	5 6 ...	7 13 ...	5 9½ ...	945 ...	1320
2. Mr. Shackel	6 3 ...	13 0 ...	7 0 ...	930 ...	1027
3. Hungarian Giant ...	7 8 ...	...	8 7 ...	930 ...	1032·5

Two of these were students at St. Thomas's Hospital; the third an Austrian now exhibiting at the Aquarium, and kindly lent to the writer for examination. All the three were singularly strong, healthy, well-proportioned men, of active athletic habits. An interesting illustration of physiological laws here incidentally cropped out, showing that, in the normal human body considered as a machine, as is the length of the osseous levers so is the sectional area of the motor muscles. This in the present instance results in an almost complete identity of the electrical resistance, increased length being very fairly balanced by increased sectional area in the conductor. A good test of morbid leanness or fatness might probably be founded on this identity.

A few words only were given to the variations of human resistance in disease and with alteration of temperature. The latter have already appeared in the columns of NATURE (on June 14 and September 13).

As regards the former, six cases of hemiplegia were cited: three on the right and three on the left side of the body, in all of which the paralysed was found less resistant than the healthy side, in amounts varying from 120 to 730 ohms. The only case which differed from this rule was that of a worker in copper, from whose secretions three milligrammes of metallic copper had been extracted, where the cupreous impregnation obviously modified the general resistance of the body, as the writer had found it to do in the case of lead and mercury also.

A confirmation of the view already expressed by the writer of the paper, that the human body follows the law of solid rather than that of fluid conductors under changes of temperature, had occurred in the instance first quoted (June 14, p. 151), where the occurrence of dropsical effusion in the lower extremities permanently reduced the resistance from the values originally given, the lowest of which was 2300, to 750 ohms.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

TEN lectures on the diseases of field and garden crops will be delivered by Mr. Worthington G. Smith, F.L.S., before the Institute of Agriculture, British Museum, South Kensington, during the week November 12-17. The lectures will be illustrated with actual examples, and new drawings of all the diseases from nature, uniformly enlarged to 1000 and 5000 diameters.

UNIVERSITY COLLEGE, ABERYSWYTH.—Mr. J. Brill, B.A., St. John's College, Cambridge, has been appointed lecturer to assist the Professor of Mathematics at this college. Mr. Brill was fourth wrangler in January 1882, and, we understand, had the honour of being one of the selected candidates for the Professorship of Mathematics at the University College, Cardiff.

SCIENTIFIC SERIALS

Revue d'Anthropologie (deuxième et troisième fascicules), Paris, 1883.—In the earlier of these two numbers M. Topinard continues the "Elementary Description of the Cerebral Convolutions in Man, in accordance with the Schematic Brain designed by Paul Broca." This is the second of the series of explanatory instructions begun in the January number. It ends with a description of the occipital fissures, peculiar to man, the simiæ, and lemurs, which Broca termed "scissure occipitale interne" and "scissure occipitale externe." In the simiæ the former of these is generally perpendicular, while in man it is often oblique in direction and irregular in position, rendering its determination difficult.—Under the title "*Transformisme*," a term used by French anthropologists for *Darwinism*, M. Mathias Duval gives the substance of his introductory lecture at the Anthropological School at Paris at the opening of the session of 1881-82. The lecturer, after giving a general idea of "transformism," passes in review the services rendered to the modern science of evolution by Darwin's precursors, Lamarck and Etienne Geoffroy Saint-Hilaire. Next he considers the re-

searches and theories of Darwin, the objections which have been made to some of his deductions, and the evidence and facts which can be brought to support his theory, with reference specially to the importance of the labours of Haeckel and other contemporary naturalists, who have contributed to the development of the Darwinian doctrines, while he lastly draws attention to the various applications of these views beyond the sphere of natural science, strictly so called.—In a paper on the Iroquois Indians Dr. Ten Kate has embodied the most important results of his observations on the physical and social condition of the pure redskins and half-breeds whom he has lately visited in the Indian reservation lands to the west of New York State. He found very few among them of pure Indian descent, but some exhibited a certain degree of prognathism, recalling the same characteristic as seen among the Malayan Liplaps. The average height of the men is 1·75 m., with a greater corresponding length of limb than is usual in whites or mulattoes. They are dolichocephalic. The colour of the eyes is reddish-brown, unlike that of any other race, while the complexion of the children is sometimes as light as that of an Italian. The half-breeds only have beards. Their principal illnesses are of a scrofulous character. The Iroquois dialects, which are gradually dying out, have not hitherto been reduced to writing, owing to the numerous anomalous guttural sounds which belong to them.—M. Bérenger-Féraud contributes an interesting paper on marriage among the negroes of Senagambia. As elsewhere among Africans, the parental tie is slight, divorce is common, women are virtual slaves, and marriages are attended with elaborate ceremonials simply as pretexts for amusements and intemperance.—M. Mondière in a review of the different races of Indo-China, supplies us with many interesting details in regard to the ethnological and anthropometrical characteristics of the Tonquins, Cambodians, and Laos, as well as of the less unfamiliar populations of Siam and Burmah.—In the third number of this year's *Revue*, we have the concluding part of Broca's description of the cerebral convolutions and fissures, which deals specially with the frontal lobes.—M. M. Duval continues his lectures on "*Transformisme*," carrying down his analysis of the most important works on the Darwinian theory of evolution to the sociological and psychological views of Herbert Spencer, and the biological researches of Huxley.—Investigations into the nature of several supernumerary muscles in the antero-internal scapulary region, by Dr. L. Testut. After Cruvilhier, who first drew attention to some of these muscles, Knott and Macalister in Ireland, and Gruber in Germany, among others, have pointed out the not infrequent occurrence of these anomalous structures in man, while in the elephant and bear, and in some of the lower quadrumana, a supernumary caraco humeral and brachial are almost always present.—The so-called "*Maye*," or May Queen of Provence, is described by Dr. Bérenger-Féraud, who traces back the festival, by which the return of the month of May is celebrated in Southern France to the ancient cult of Maia, the mother of Mercury, among the founders and Greek colonists of Marseilles. In modern times the worship of the Pagan Maia has been transferred to the Virgin Mary, in whose name alms are solicited for the little girl-child, who, veiled, and nearly buried in flowers, is supposed to represent the much venerated "Notre Dame du Mai" of Provence. These Provençal May festivals are thus closely allied to the so-called "floral games," which still survive in Cornwall, and repeat on each 8th day of May some part of the ancient Roman worship of the goddess Flora.—M. Deniker passes in review the results of the travels of M. Miklouho-Maclay on the east coasts of New Guinea, and summarises the information derived from his careful study of the Papuan races of the island, giving at the same time a number of important anthropometric measurements, together with numerous interesting ethnological and social data.

Zeitschrift für wissenschaftliche Zoologie, Band xxxviii. Heft 3, July, 1883, contains: On the embryology of *Planaria polychroa*, by Dr. E. Metschnikoff (plates 15 to 17).—On the Cœlenterata of the Southern Ocean, part 3. On the Nematophores of Plumularidæ, and on urticating cells in the mesoderm (Schirmgallerte) of *Crambessa mosaika*, by Dr. R. von Lendenfeld (plate 18).—On Karyokinesis in some Protozoa, by Dr. A. Gruber (plate 19) (*Actinosphærium eichhornii* and *Amœba princeps*).—Contributions to a knowledge of the development of the Gastropods, by Dr. F. Blochmann (plates 20, 21).—On the glands of the mantle-edge in Aplysia and kindred forms, by Dr. F. Blochmann (plate 22).—Contributions to a knowledge of the Medusæ, by Dr. Otto Hamann (plate 23).—On the cerebrum of birds, by Dr. A. Bumm (plates 24, 25).—On *Girardinus caudimaculatus*, by Dr. Hermann von Ihering (plate 26). An interesting study of this little limnophagus Cyprinoid found in Rio Grande do Sul.—Contribution to technical histology, by Prof. H. Fol.

Heft 4, August, 1883, contains: On the Cœlenterata of the Southern Ocean, part 4. On *Eucopella campanularia*, a new genus belonging to the Campanularidæ, by Dr. R. von Lendenfeld (plates 27 to 32). This memoir consists of a very elaborate and detailed description of both the hydrosome, gonophore, and ova of this new species.—On the egg-shell (*Eihaut*) of *Python bivittatus*, with remarks on some other reptile eggs, and on the genesis of their outer layers, by W. von Nathusius-Königsborn (plates 33, 34).—Researches on some new Medusæ from the Red Sea, by Dr. C. Keller (plates 35 to 37).—On the manner of propagation in *Proteus anguineus*, by Marie von Chauvin (plate 38).

Archives Italiennes de Biologie, tome iii. fasc. ii. May 20, 1883, contains:—On medical instruction in Italy, by Prof. J. Bizzozero.—On the sanitation of the Roman Campagna, by C. Tommasi-Crudeli.—On the therapeutic effect of prolonged tepid baths in pneumonia and typhoid fever, by C. Bozzolo.—On the structure and affinities of the olfactory lobes in the higher Arthropods and the vertebrata, and on a contribution to the histogenesis of the internal molecular layer of the retina, by G. Bellonci.—On organic particles in the air of high regions, by P. Giacosa.—On the action of cotoine and paracotoine, by P. Albertoni.—On lung epithelium and its transformations in disease of that organ, by C. Bozzolo and B. Graziadei.—On the comparative anatomy of the skull of the Terramare pig, by Prof. P. Strobel.—On ptomaines, by J. Guareschi and A. Mosso.

Fasc. iii. July 31, 1883, contains:—On the partial regeneration of the liver, by G. Tizzoni and V. Colucci.—On the presence of cystoliths in some Cucurbitaceæ, by O. Penzig (plate).—On the histology of the nervous centres, by C. Golgi (4 plates).—On the action of iodoform in saccharine diabetes, by C. Bozzolo.—On the normal structure and on alteration caused by experiment in the pacinian corpuscles of birds, by Josephine Cattani.—On negro anatomy, by Prof. C. Giacomini: (1) on the cartilage of the semi-lunar fold in the eye; (2) Graafian follicles.—On the development in Salpa, by Prof. F. Todaro.—On some experimental researches as to a new automatic centre in the bulbo-spinal tract, by Dr. J. Fano.—Anthropometric studies of criminals, by Prof. H. Ferri.—On the anatomical merits of Jerome Fabrizi d'Acquapedente, by Prof. G. Romiti.—On the secretion of bile, by Dr. B. Baldi.—On inoculation of leprosy, by R. Campana.

Proceedings of the Isis Natural History Society, Dresden, January to June, 1883.—Obituary notice of Karl Ch. G. Nagel, by H. Engelhardt.—Perceptive faculty of insects and other lower animals, by Prof. B. Vetter.—Fauna of the Suez Canal, by Dr. C. Keller. Up to the present time eleven Mediterranean species have penetrated for the most part as far as Suez, while the Red Sea yields twenty-five species, which, however, have as a rule scarcely yet reached half way towards the northern entrance.—On a case of albinism observed in the Heidelbeer district, by H. Engelhardt.—A comparative study of the flora of the Erzgebirge and Riesengebirge, by Dr. R. Kell.—On the theory of shifting continental and insular climates, with special reference to the vegetable relations of Norway, by Cl. König.—On the so-called "compass plants," by E. Stahl.—On the exploration of the flora of Lapland made by Linné in 1732, by Dr. O. Drude.—On the presence of Anodonta and Planorbis in the Tertiary lignite beds of Schellenken, by Dr. Deichmüller.—On the source of the nephrite found in North Germany, by H. Credner.—On the river valley formations in the Western Erzgebirge, by J. Jacobi.—On the geological formations of Mittweida, with special reference to its flora, by R. Beck.—On a fossil bird from the Bohemian chalk beds, by H. B. Geinitz.—On the presence of copper in the syenite of the Plauenscher Grund, Saxony, by F. Zschau.—On the limits of the Dyas and Trias systems, by A. Dittmarsch.—On the relation of the protoarseniate of iron to the iron oxide in the magnetic iron ore of Berggiesshübel, by H. Vater.—On G. Laube's "Traces of Man in the Quaternary Formations of the Prague District," by Dr. Deichmüller.—On the bronze and iron objects found in the clay beds of the Wendish Circle, Lievland, by A. Engelmann.—On H. Schliemann's "Ilios, City and Land of the Trojans," by H. B. Geinitz.—On a prehistoric find on the Hradischt near Stradonitz, by W. Osborne.—On an ancient burial place at Kunzowo, by F. Raspe.—Find of stone axes at Dippoldiswald, by H. Wiechel.—Or

some new views respecting the mutual relations of biological and chemical research, by D. W. Hentschel.—On Prof. Lindemann's proof that π is not an algebraic quantity, by Dr. Harnack.—On the preparation and application of perspective models in relief, by Dr. Burmester.—On the general theory of the so-called P.E. system, by Prof. Voss.—On the supposed coprolite deposits of Helmstadt, Büddenstedt, and Schleweke, near Harzburg, by Dr. H. B. Geinitz.—Memoir on the diluvial glaciers of North Europe, with special reference to Saxony, by Dr. H. B. Geinitz.—A Gaulish double grave at La George-Maillet, Marne, by D. von Biedermann.—Monograph on the climate of the Glacial epoch, by Heinrich Vater.—The diamond fields of the Cape, by Thaddeus Schrader.

SOCIETIES AND ACADEMIES

LONDON

Mineralogical Society, October 22.—Anniversary Meeting.—W. H. Hudleston, F.G.S., president, in the chair.—The following were elected officers and Council for the coming session:—President, Rev. Prof. Bonney, F.R.S. Vice-Presidents: Rev. S. Haughton, M.D., F.R.S.; W. H. Hudleston, M.A., F.G.S. Council: G. S. Boulger, F.G.S.; C. O. Trechmann, Ph.D., F.G.S.; Mr. J. Stuart Thomson, Rev. Prof. Wiltshire, F.G.S. (in place of Messrs. Church, Danby, Merry, and Walker). Treasurer, R. P. Greg, F.G.S. General Secretary, R. H. Scott, M.A., F.R.S. Foreign Secretary, C. Le Neve Foster, D.Sc, F.G.S. The Secretary read the Report, which was adopted. The outgoing President delivered a short address, and the chair was taken by Prof. Bonney, when the following papers were read:—J. Stuart Thomson, on crystals of calamine from Wanlockhead.—A. S. Woodward, on the occurrence of Evansite in East Cheshire.—Mr. S. Henson exhibited a magnificent group of crystals of stibnite from Japan.—A vote of thanks to the outgoing president, Mr. Hudleston, concluded the proceedings.

SYDNEY

Royal Society of New South Wales, September 5.—C. Moore, F.L.S., vice-president, in the chair.—Five new members were elected, and eighty-nine donations received. The following papers were read:—Notes on the genus Macrozamia, with descriptions of some new species, by C. Moore, F.L.S.—A list of double stars, by H. C. Russell, B.A., F.R.A.S.—Some facts connected with irrigation, by H. C. Russell, B.A., F.M.S., &c.—On models for showing crystallographic axes, by Prof. Liversidge, F.R.S.—On the discolouration of white bricks made from certain clays in the neighbourhood of Sydney, by E. H. Rennie, M.A., D.Sc.—Mr. J. K. Hume exhibited a collection of Carboniferous fossils from Cataract Creek near Mount Wellington, Hobart, Tasmania, which were described by C. S. Wilkinson, F.G.S.—Prof. Liversidge exhibited a fossil specimen of an extinct Chelonian reptile (*Notochelys costata*, Owen) from the Flinders River, Queensland, being the first Chelonian found in Australia.

PARIS

Academy of Sciences, October 22.—M. Blanchard, president, in the chair.—River navigation; endless chain towing, by M. Dupuy de Lome. The author describes the recent experiment made on the Rhone of a new system of towage, which appears satisfactorily to solve the problem of the economic transport of goods on this most difficult of navigable rivers, and, *a fortiori*, on all streams with a moderate current. The success of the experiments is due to the employment of two endless lateral chains, worked with independent machinery by a single hand, and serving at the same time to steer the vessel.—Note on a formula of Hansen applicable to the celestial mechanism (continued), by M. F. Tisserand.—Disinfection of ornamental plants intended for exportation, by M. Laugier. The successful experiments made in concert with Dr. Kœnig of Asti at the Agronomic Station of Nice in December, 1882, were renewed during the month of September last with most satisfactory results.—Note on some arithmetical theorems, by M. Stieltjes.—On surfaces whose curve is constant, by M. G. Darboux.—On the law regulating the distribution of tension in an elastic plate of arbitrary primitive form encircling a cylinder of any right section, in cases where the friction is uniform, by M. H. Léauté.—On the movement of a rolling weight along an elastic horizontal rod fixed at both ends in cases where the mass of the rod is much smaller than that of the weight, by M. J. Boussinesq. A wider application is here shown of the problem of rolling masses solved by Willis and Stokes, as described in the paper inserted by Stokes in the *Cambridge Phil. Trans.*, vol. viii. 1849.—Observations on a reply of M. Faye touching diverse phenomena of solar spectroscopy (*Comptes Rendus*, October 8, p. 779), by M. L. Thollon.—On the inductive force due to the variation of intensity in the electric current of a flat spiral multiplication, and on the comparison of this force with that exercised at great distances by a spherical solenoid or a solenoidal fictitious sun, by M. Quet.—Note on the determination of the equivalents of copper and zinc by means of their sulphates, by M. H. Baubigny.—On the transformation of hydrocarburets into corresponding aldehydes by means of chlorochromic acid, by M. A. Etard.—Note on the state of the sensitive nerves during the excitement produced by strychnine, by M. Couty.—On two cases of peripheric nervo tabes (ataxy of the lower members, combined with absolute integrity of the posterior roots, of the spinal ganglia and spinal marrow), by M. J. Dejerine.—On the secreting epithelium of the kidney of Batrachians (triton and axolotl), by M. J. Bouillot.—On the extent and age of the dioritic formations of Corsica, by M. Dieulafait. Instead of occupying a deep continuous vertical range, as hitherto supposed, the author shows that the Corsican diorites belong to three distinct systems—granites at San Luccia di Tollano and Ajaccio, ophiolithic or serpentine rocks of the Triassic and Permian formations at Bastia and elsewhere. With these last are exclusively associated the numerous sulphuretted metalliferous ores occurring in the island.—A discussion of the causes to which is due the movement of glaciers, by Mr. Walter R. Browne. This movement is here attributed rather to atmospheric causes (pressure and temperature) than to gravitation.—Observations on an earthquake felt at Ghadames (Algeria) towards the end of last August, by M. Duveyrier.

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